July-August 1956

Communications—Electronics—Photography

SIGNAL

Report

OF

THE

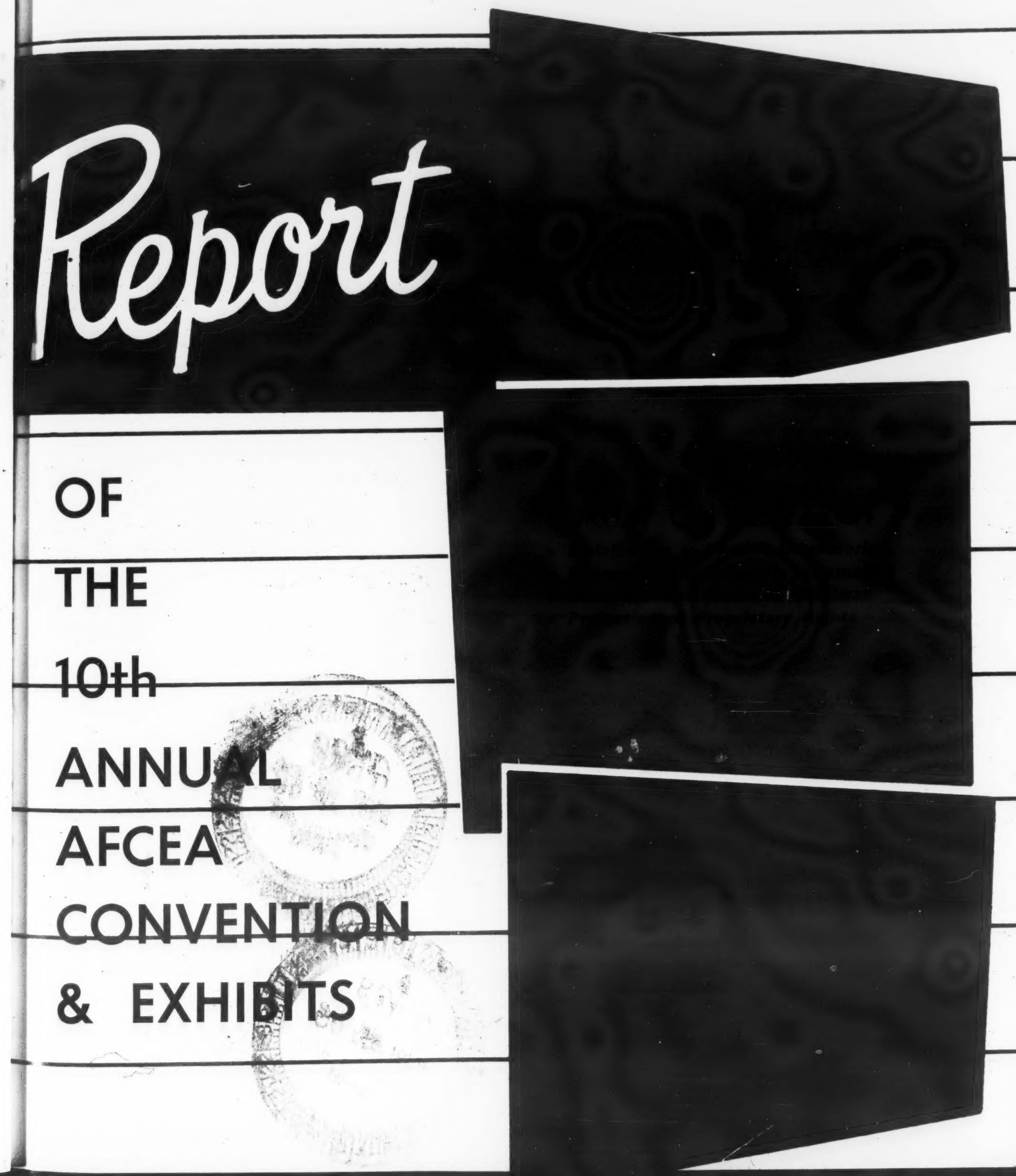
10th

ANNUAL

AFCEA

CONVENTION

& EXHIBITS



for the HIGHEST in RELIABILIT

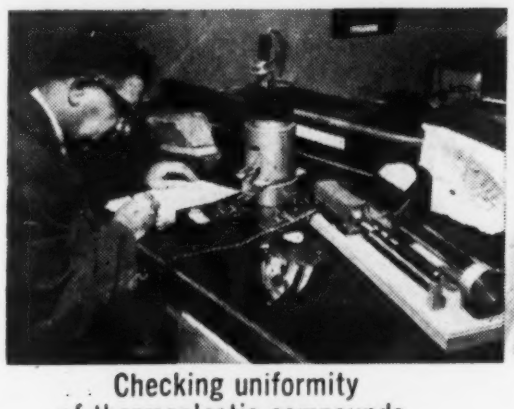
Qualitative micro analysis.

Vibration stress analysis.

Torque testing of standard assemblies.

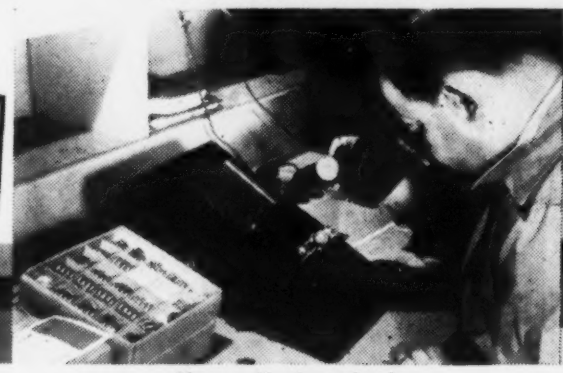
WHAT MAKES A TRANSFORMER FAIL?

Illustrated are a few views of the UTC Reliability Laboratory in action... finding the answers.



Checking uniformity of thermoplastic compounds.

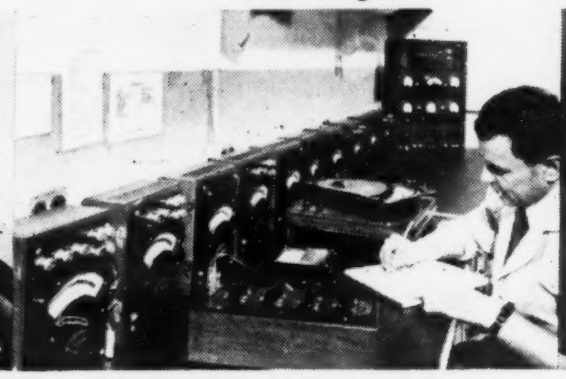
Quantitative checking of weld strength.



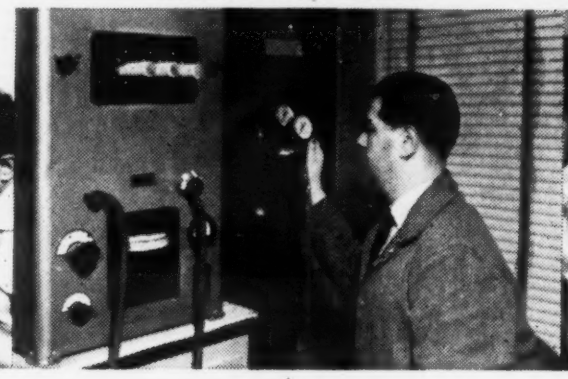
Hermetic terminals on microscope check.

Chemical section analyzing new materials.

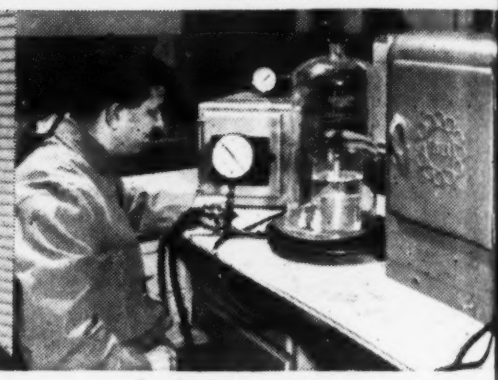
Microscope analysis of dissected units.



Calibration to primary standards.



Pilot plant hydrogen annealing.

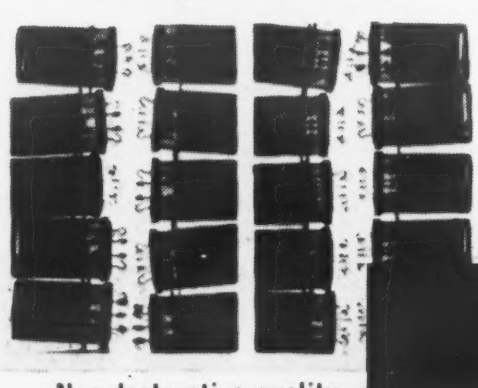


Seal tests under extremes of cold, heat, and altitude.

Abrasion and mercury tests on magnet wire.

Pilot plant run on encapsulating material.

Corrosion testing on insulating materials.



Non-destructive quality control by x-ray.

IS THIS PROVEN RELIABILITY AND UNIFORMIT IN THE COMPONENTS OF YOUR EQUIPMENT?

A large aircraft company..."Our vendor analysis for past year (thou sands of tests) shows zero rejects."

A large electric company..."Consistent quality has placed you as ou #1 source...are grateful for the aid you have given our own quality control staff."

A large military electronics company..."Switching from former vendo to UTC has saved us 18% of transformer and filter cost by reducing manufacturing costs."

A large instrumentation company..."We haven't had one field failure in fifteen years' use of UTC parts*."

*Over 100,000 units.

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Courtesy and resourcefulness qualify her for the job. Gaye Evans, telephone company Service Representative, obtains information for a customer regarding his telephone service.

PHOTOGRAPHS BY ANSEL ADAMS

She Likes to Help People

A story about one of the telephone Service Representatives whose "voice has the smile" whenever there's anything you'd like to know about telephone service.

One of the nice things about the telephone business is the way it brings us close to people.

Many, many times each day—in your community and in countless communities throughout the land—we have the opportunity and the privilege of friendly contacts with those we serve. Sometimes they are by telephone. Very often they are personal visits.

Among those who have these contacts are Business Office Service Representatives like Gaye (Mrs. Robert) Evans.

"What we like people to do," says Gaye, "is to think of us as their personal representatives at the telephone company. Whenever there's any question about service or a bill or you're moving or needing more service, we're here to help in every way we can."

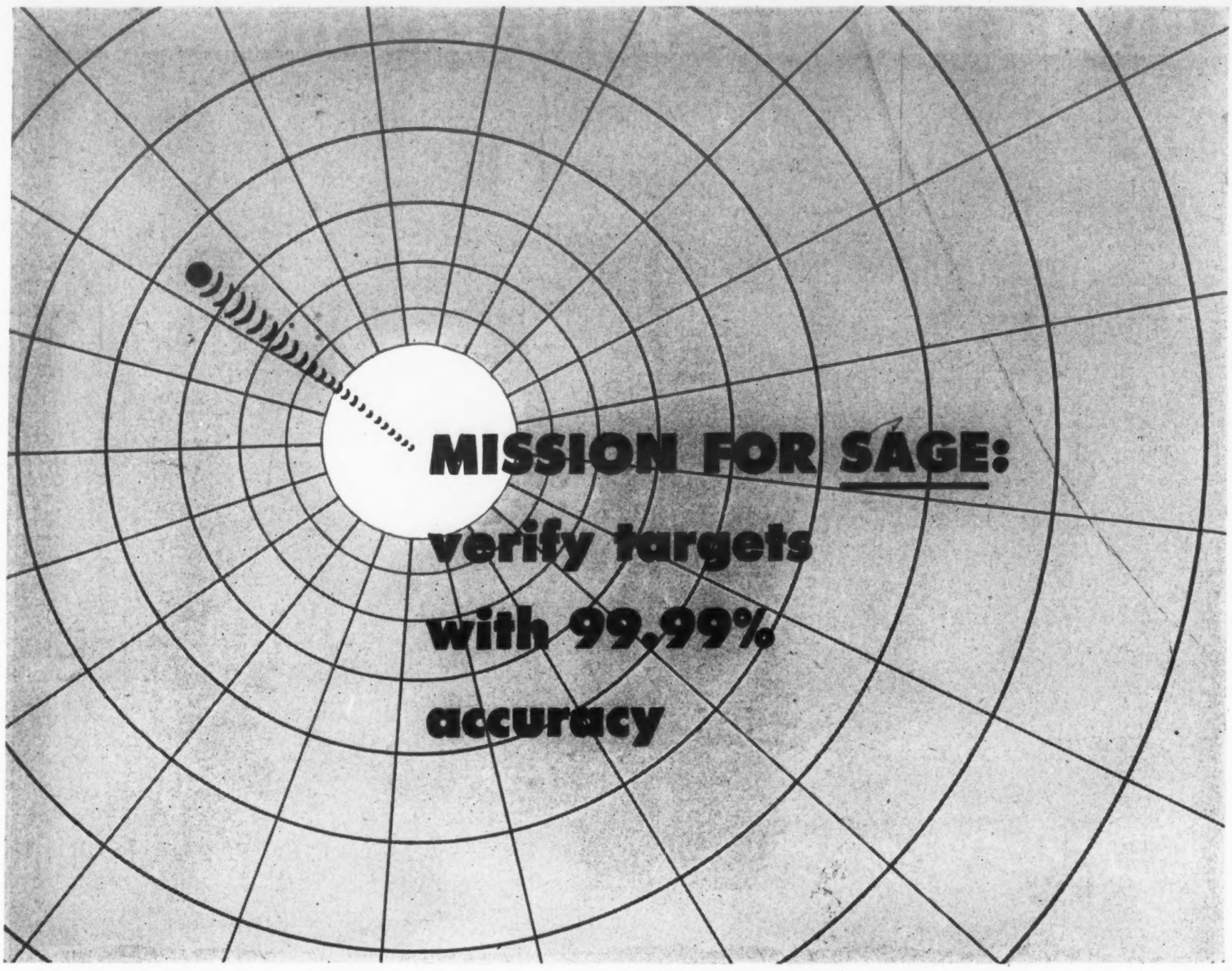
Gaye Evans' job takes a special type of person. One who is not only efficient but understanding as well.

Gaye qualifies in many ways. Even in her leisure hours, she finds time to help others, especially the handicapped and the needy. Another of her activities is rehearsing a 26-girl choir.

Gaye sums up one of her main satisfactions this way: "It's nice to have people think of the telephone company as a place where they can always find courtesy and consideration. That's our job and we try to be good at it."

Helping the Blind. Raising money to provide "Guide Dogs for the Blind" has been one of Mrs. Evans' activities in the Venture Club—an organization of Oakland (Calif.) business women.

BELL TELEPHONE SYSTEM



LEWYT CDT* restricts false targets to one in ten thousand

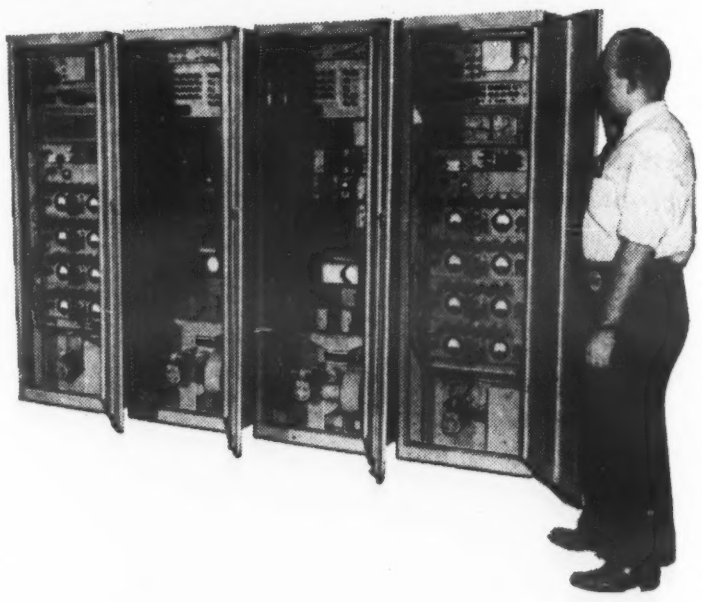
In the deadly serious task of identifying targets with unmatched accuracy...this compact "brain" carefully screens and interprets radar pulses at the rate of 161,800 per second. Automatically separating interference from true target data, it converts this crucial information into signal form for transmission over telephone wires to coordinating control centers.

Lewyt engineered and built into this data handling equipment the monitoring and sensing features that will provide continuous unfailing operation. Such reliability will contribute materially to the effectiveness of our overall air defense system.

Conceived by the Air Force and developed in close cooperation with M.I.T.'s Lincoln Laboratories...CDT is another example of Lewyt's engineering skill and resourcefulness in the application of the most advanced electronic techniques.

A brochure of other case histories is available by writing: LEWYT MANUFACTURING CORPORATION, Department S-7, Long Island City 1, N.Y.

**Coordinate Data Transmitter System*



LEWYT

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BPA

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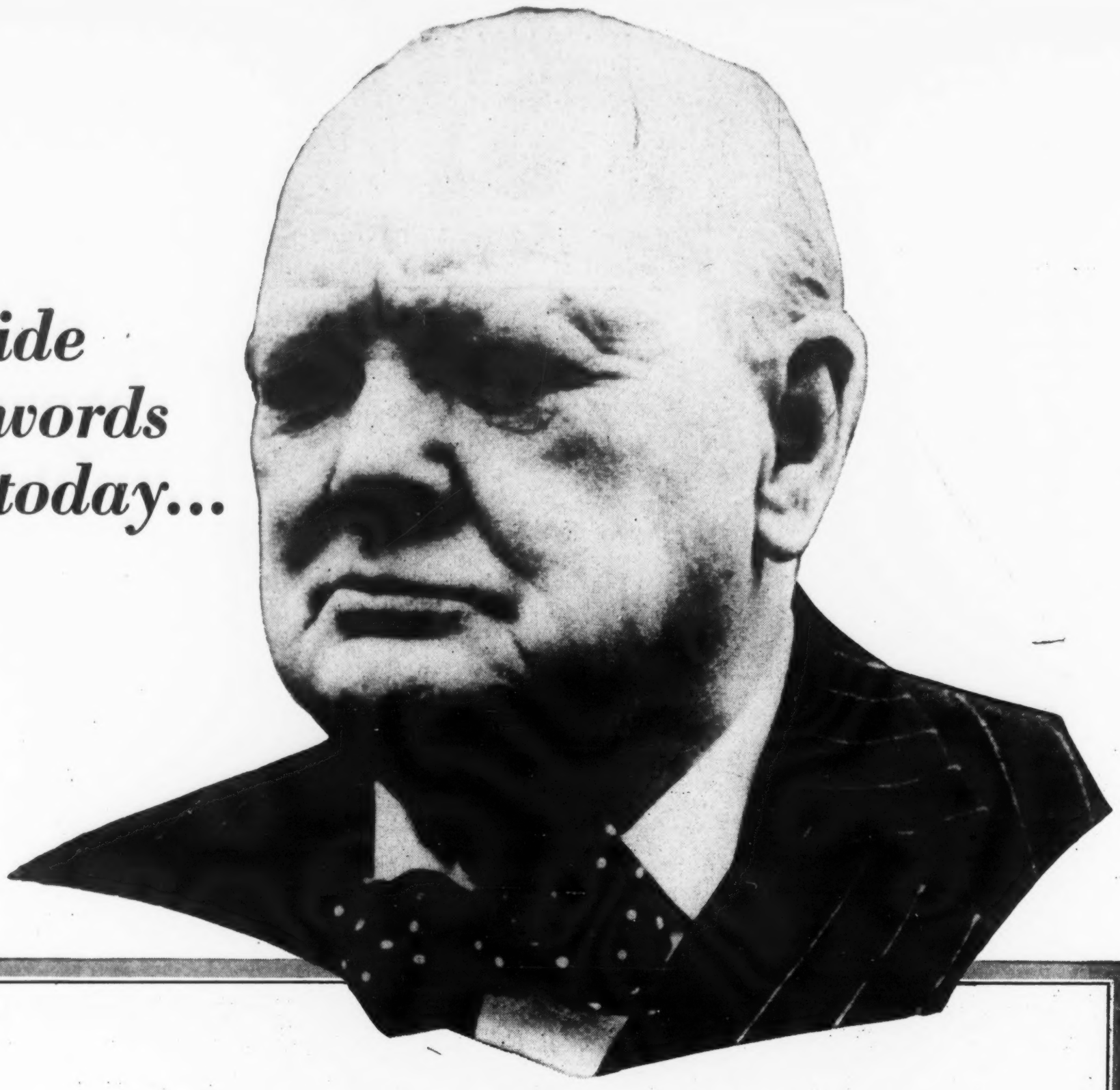
Guide words for today...



"The day will come when it will be recognized without doubt throughout the civilized world . . . that the strangling of Bolshevism at birth would have been an untold blessing to the human race."

WINSTON CHURCHILL

The day Churchill foresaw is here. The iron grip of Communism now holds more than one third of humanity in bondage. It should be clear to all thinking people that mere "peaceful coexistence" will not halt the Kremlin's march to world domination. Whatever their current "cold war" tactics may be, the Communists offer nothing to the human race but poverty, bloodshed and suffering.

PRESIDENT

DUTY HONOR COUNTRY — LABOR BUSINESS GOVERNMENT

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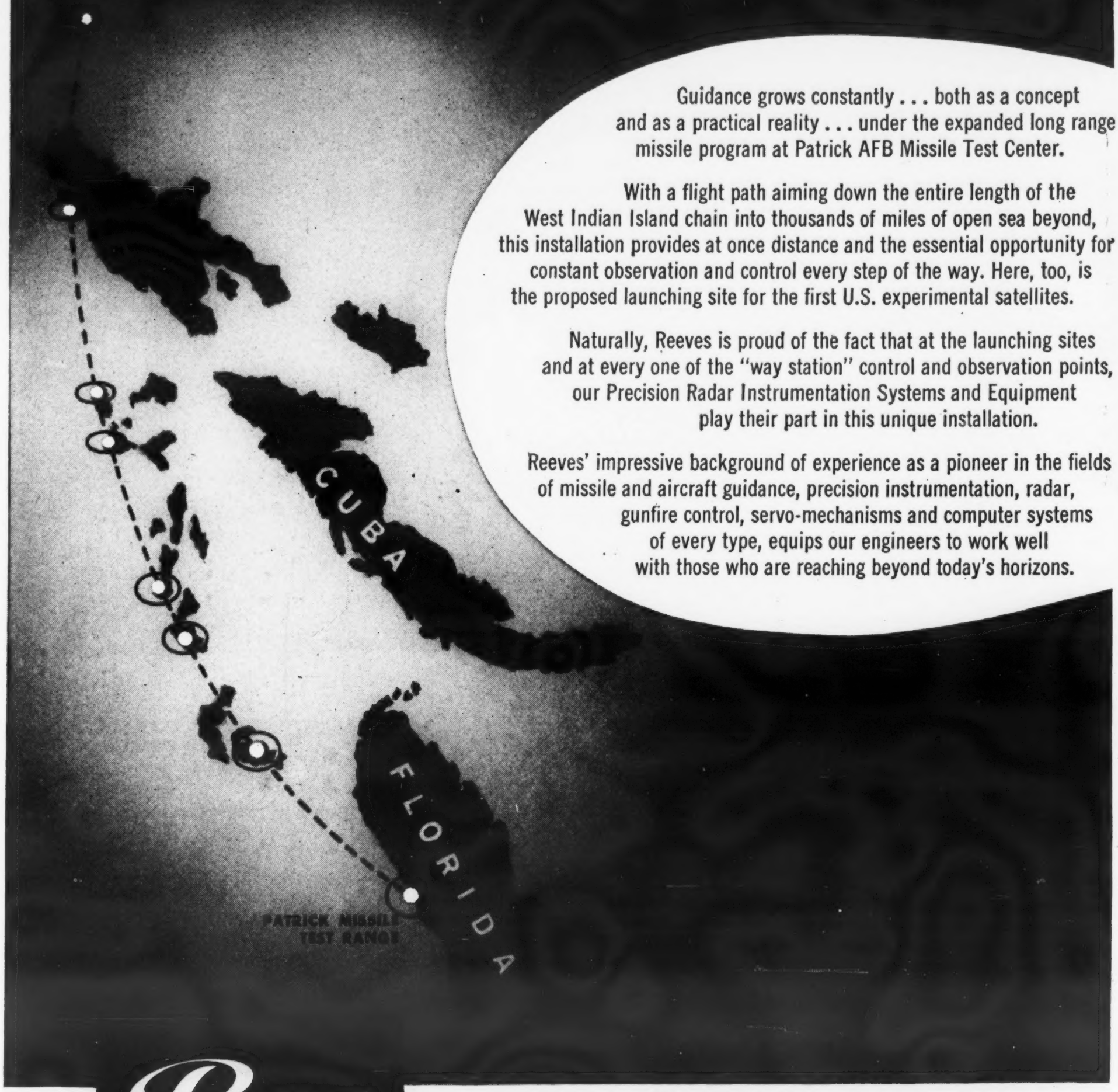

Guidance grows constantly . . . both as a concept and as a practical reality . . . under the expanded long range missile program at Patrick AFB Missile Test Center.

With a flight path aiming down the entire length of the West Indian Island chain into thousands of miles of open sea beyond, this installation provides at once distance and the essential opportunity for constant observation and control every step of the way. Here, too, is the proposed launching site for the first U.S. experimental satellites.

Naturally, Reeves is proud of the fact that at the launching sites and at every one of the "way station" control and observation points, our Precision Radar Instrumentation Systems and Equipment play their part in this unique installation.

Reeves' impressive background of experience as a pioneer in the fields of missile and aircraft guidance, precision instrumentation, radar, gunfire control, servo-mechanisms and computer systems of every type, equips our engineers to work well with those who are reaching beyond today's horizons.

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The shark's instinctive system of coordinated steering and diving control, endowed by nature, has been duplicated for America's most recent submarines by Warren Manufacturing Company, Inc.

Our underseas craft now can maneuver and strike with shark-like coordination, due to this effortless, responsive system of single-source control. The Warren magnetic amplifier type, electro-hydraulic servo control system now assures instantaneous submarine response subject to one-man command.

The result? American underseas craft can now maneuver more positively, more efficiently... to give our country a stronger arm of defense.

Creative engineering available at Warren Manufacturing has solved many difficult control problems in private industry too! Our wide experience in the field of feedback control could be the missing ingredient in the solution of your automation problem.

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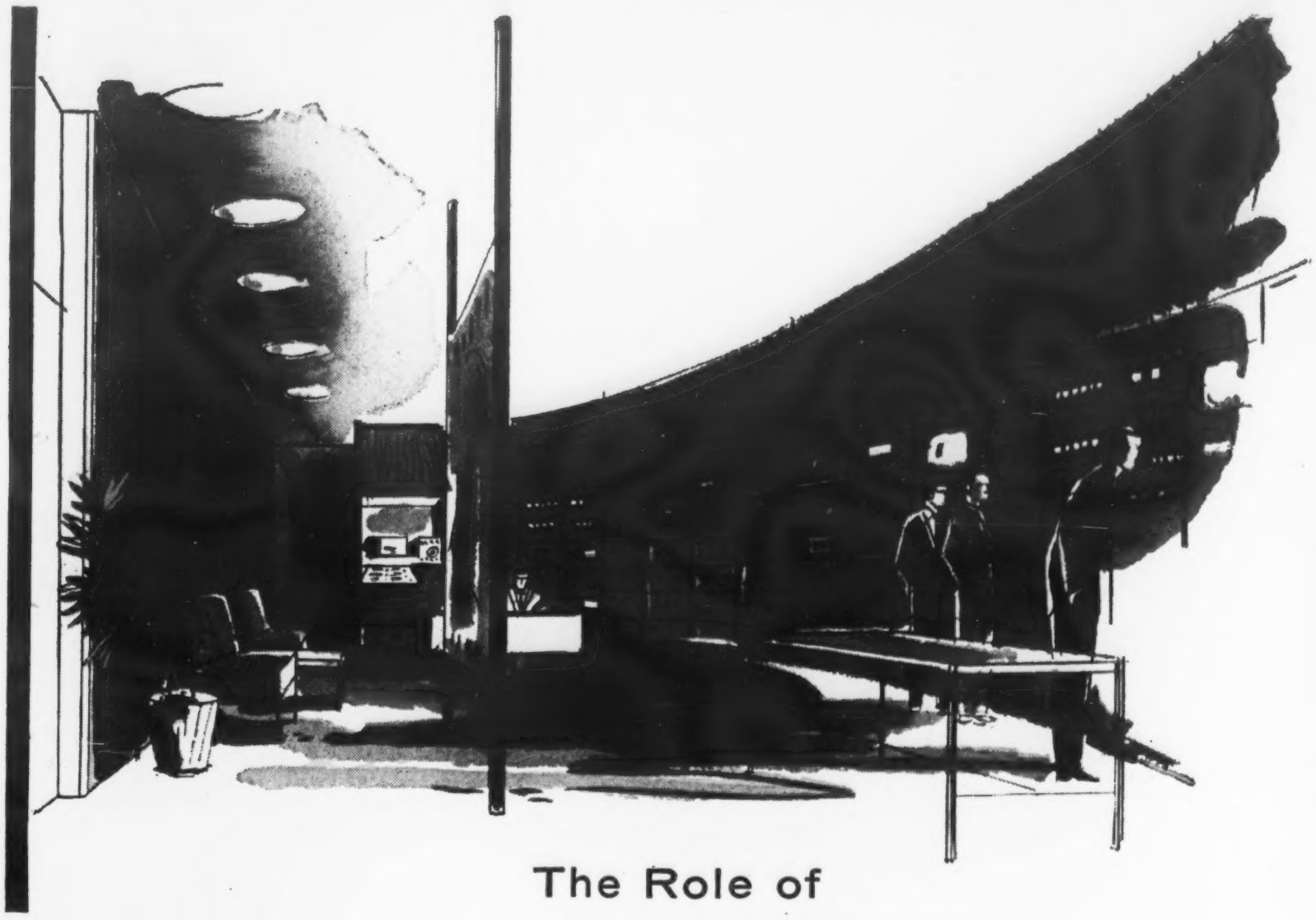
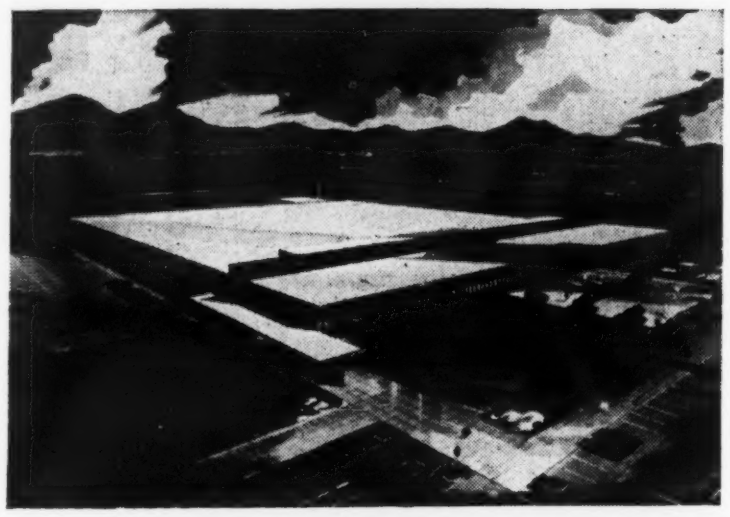
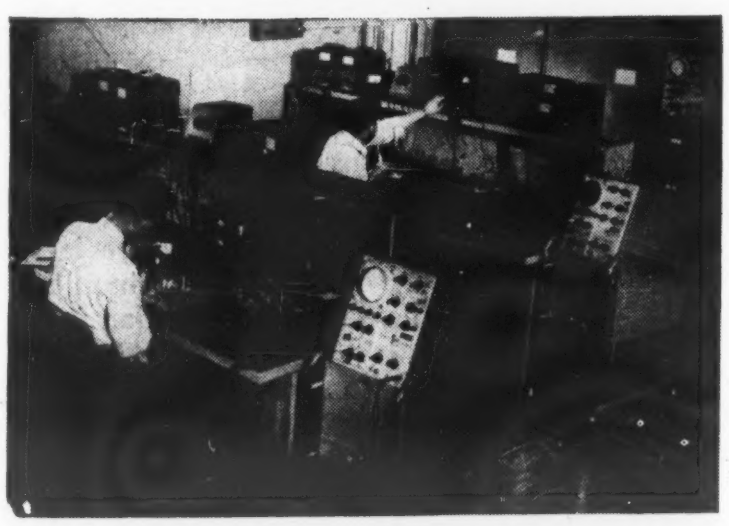


R-W Data Reduction Center now under construction



Denver plant now under construction will augment the Division's manufacturing facilities



Instrumentation development

The Role of INSTRUMENTATION and TEST EQUIPMENT in Systems Work

The complexity of modern weapons systems, as well as certain electronics systems for industrial applications, is such that the design and installation of instrumentation for obtaining experimental test data and converting it into usable forms has become a highly specialized field of technology.

A closely related field is that of test equipment needed for the adjustment and maintenance of the end-product hardware, both in the manufacturing plant and in the field. Experience has shown that the effectiveness of a major new system frequently falls short of its potentialities because of inadequate attention to this essential supporting activity.

In The Ramo-Wooldridge Corporation, the Electronic Instrumentation Division has the mission of bringing to the areas of instrumentation and test equipment a level of competence that is adequate to deal with the often very difficult problems that need to be solved in such work.

Assignments undertaken for a number of government and industrial customers include such diverse projects as flight instrumentation, data reduction equipment, and transistorized power supplies. Another important project of this Division is that of providing The Ramo-Wooldridge Data Reduction Center with a system and arrangement of equipment carefully designed to meet the company's specific requirements. Also in progress is the development and fabrication of field test equipment for an electronic system R-W now has in early production.

A unique and important feature has been incorporated into the services offered by the Electronic Instrumentation Division. For each project, an advisory committee is established composed of experienced systems engineers from other divisions of the company. By periodic reviews, such advisory committees assure that the development work of the Electronic Instrumentation Division takes into account the very special and often not well understood needs which arise in systems work.

Further information about this R-W activity can be obtained by writing to the Director, Electronic Instrumentation Division.

The Ramo-Wooldridge Corporation

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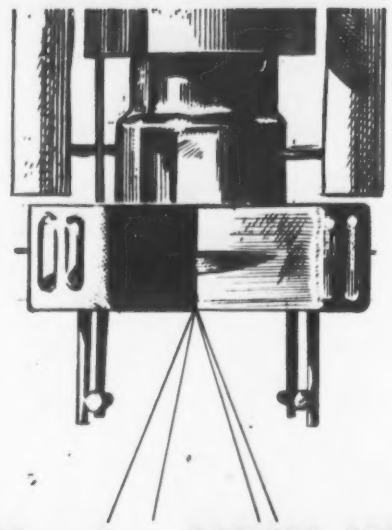

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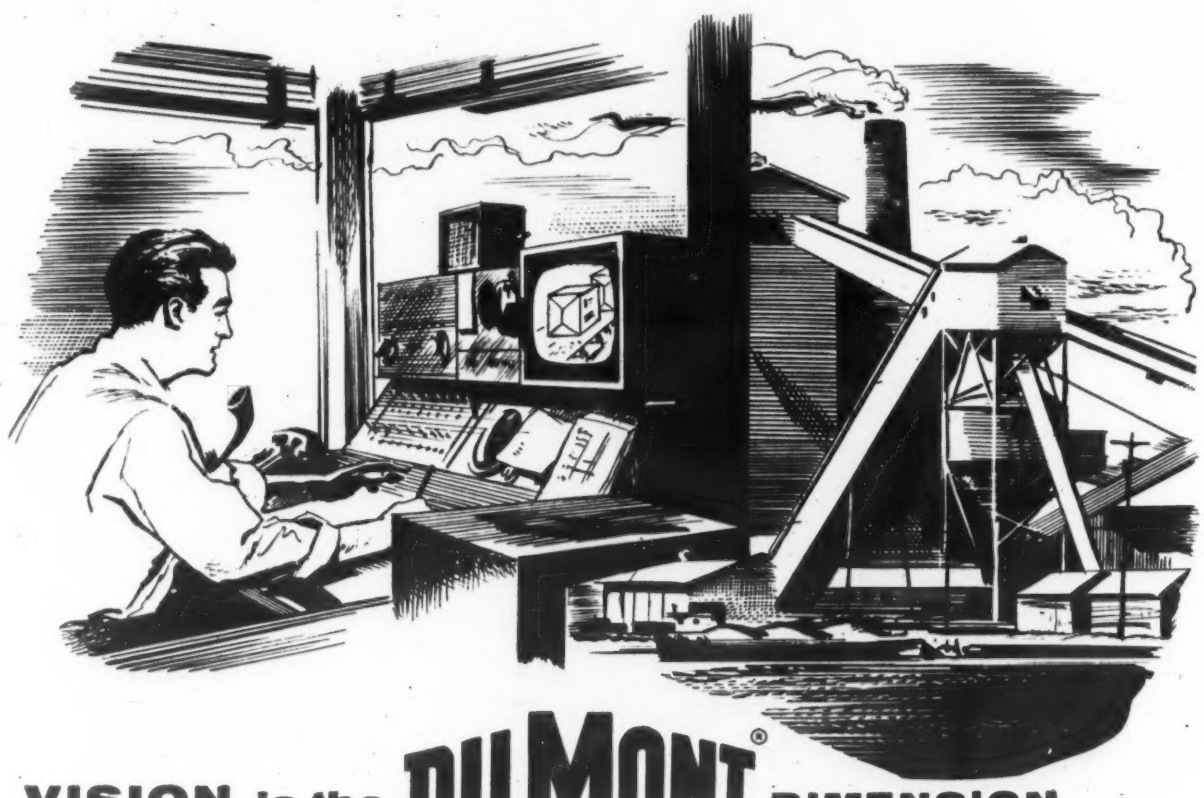
VISION of a NEW WORLD through today's electronic windows

In the magnificent march of modern electronic progress, few destinations are beyond reach.

Already, in America, new electronic developments are energizing industry and revolutionizing defense. Already, television is introducing wider interests and higher standards of living to millions of homes. The consumer benefits . . . the whole economy benefits...as the nation builds better products more efficiently at less cost through electronic progress!

This new cycle of better living began with Du Mont's pioneer vision in television, in radar, in electronic instruments and precision methods. Today, the world enjoys Du Mont benefits even in many products which do not carry the Du Mont name . . . because every day, Du Mont experience helps to put electronic vision on the production line, for great industries with new destinations.



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Letter to the Editor

More on Manpower and Reserve

DEAR SIR:

This country has surged to the front of the world in the field of scientific and engineering achievements. This, of course, has materially advanced our economic strength, out of which our military has drawn an ever-increasing capability for defending our Nation and its people.

In this crucial period of history, it is essential that the United States continue its scientific and technological advantages. Equally important, I believe, is the buttressing of our technological forces by trained leaders, skilled manpower and a male population not totally lacking in the rudiments of the military profession — and last but not least, a well-informed citizenry who understand the issues at stake and the terrible and irrevocable consequences of failure.

The Reserve Forces Act of 1955 offers the young man an opportunity to fulfill his military obligation prior to entry into his chosen vocation. The advantage to a young man pursuing an occupation which demands extensive preparation is particularly apparent. A young man may serve with the active Army for a six-month period under the new Reserve Program, and then turn his full attention — with lessened risk of further interruption — to devoting himself to his life's work.

Our experience in the last few months indicates that our first task is to be sure that American youth and their parents are fully informed of these advantages. We also believe an equally important and parallel task is insuring that civic leaders and industry are aware of the advantages offered by the new program to them in their status as employers and leaders in the American community. We also believe that the whole Nation should be shown the Reserve Forces Act as a step forward in tightening our defense, while at the same time hampering the pursuit of a normal civilian course of life to a lesser degree.

Any assistance which your Association can render to the program in the way of obtaining the aid of civilian industries throughout the Fifth Army area in acquainting the parents and youths with the new Reserve program will be greatly appreciated. Allow me to extend the cooperation of the Fifth Army to any of your representatives working on this program within our area. I assure you that we will be most happy to furnish all assistance at our disposal in furthering this vital facet of the Nation's defense.

LT. GEN. W. H. ARNOLD, USA
Commander, Fifth Army

WARM WELCOME

Stewart-Warner Electronics today detects the presence of high-performance aircraft, identifies it as friend or foe and can provide a warm missile welcome in an instant.

Research and development at Stewart-Warner Electronics have produced these advanced systems. The program is still expanding, as are the opportunities for the exceptionally well-qualified engineer.

Today as yesterday, Stewart-Warner Electronics safeguards our skies with tomorrow's planning and production.

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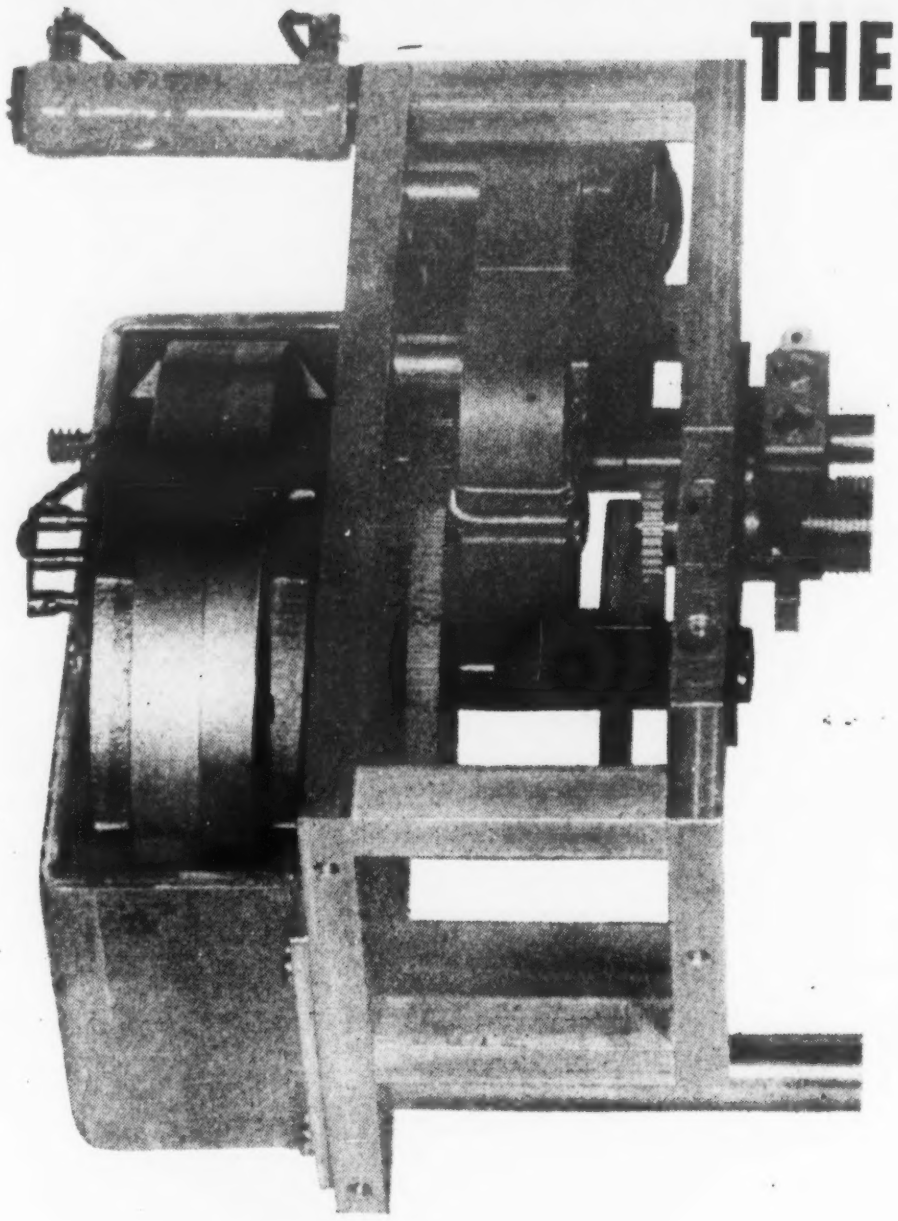
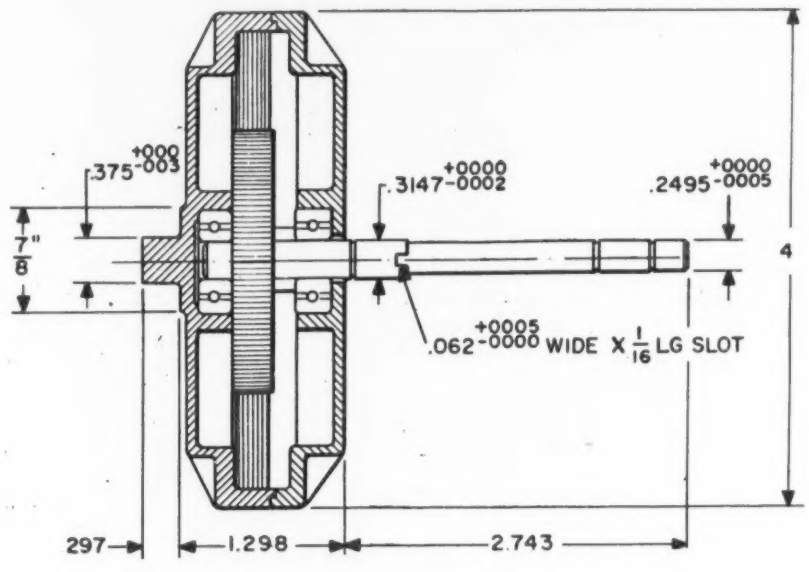
CONSTANT ANGULAR ROTATION FOR PRECISE SPEED CONTROL!

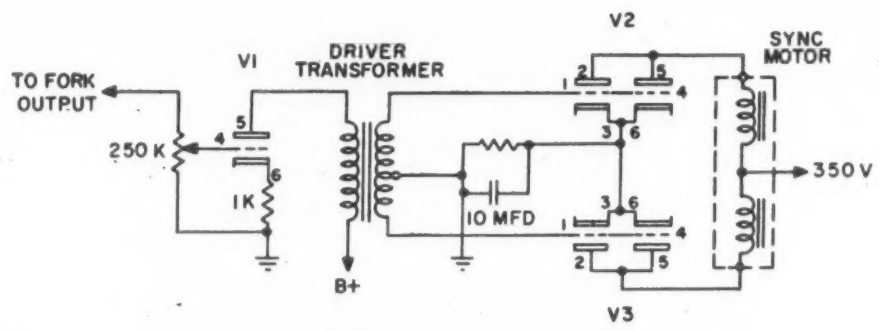


THE TIMES FACSIMILE MS-2 SYNCHRONOUS MOTOR

is a phonic wheel type motor capable of operating from vacuum tube amplifiers on signal from frequencies 60 to 4000 cps. It was designed specifically to provide the extremely accurate and invariable speed required for driving fork-synchronized facsimile equipment. The previous model (MS-1) has proved itself by years of continuous duty in communications service. Its unique characteristics will be found the answer to many problems involving the need for constant angular rotation or precise synchronization.

The Model MS-2 Motor can be operated single phase in the plate circuit of a single-ended amplifier or as a two-phase motor when driven by a push-pull amplifier. The latter is recommended since the two-phase connection runs quieter and provides more power with less heating. The motor current is approximately 75 milliamperes per phase. The power input may be as high as 20 watts.





NOTE: Tube types recommended for V2 and V3 are 6SN7GTB, 6BL7, 6BX7 and triode connected beam power pentodes. Selection should be based on power requirements. Cathode resistor is selected to give the desired DC current through the motor windings.

Complete information and prices will be mailed promptly on request.

DESCRIPTION

TYPE — phonic wheel variable reluctance synchronous motor.

DIRECTION OF ROTATION — determined by start motor.

DRIVING FREQUENCIES — 60 to 4000 cps.

NUMBER OF PHASES — 2.

MAX. MOTOR CURRENT — 75 ma per phase.

MAX. POWER INPUT — 20 watts.

MAX. SYNC. TORQUE — 6 in. oz. at 1800 rpm.

MAX. POWER OUTPUT — up to 1/50 hp. depending on input frequency.

SYNC. SPEED — rpm = driving frequency when connected directly in amplifier plate circuit.
Rpm = 2 x driving frequency with AC only.

MAX. INDUCTANCE — .8 h.

MIN. INDUCTANCE — .4 h.

ROTOR INERTIA — 3.2 oz. in.^{2}

MAX. FREQUENCY ACCELERATION —
1000 cycles/sec./sec. from 500 through 2000 cps, no load.

DUTY CYCLE — continuous.

BEARINGS — class 7 precision ball bearings.

WEIGHT — 1½ lbs.

SUGGESTED USES — timing devices, facsimile, commutators, recorders, frequency servo units, variable frequency dividers.

TIMES FACSIMILE CORPORATION

540 West 58th Street, New York 19, N. Y. • 1523 L Street N. W., Washington 5, D. C.

★

COLONEL GEORGE P. DIXON AUS (RET.)

★

★

1889

•

1956

★

Colonel George P. Dixon, executive head of the AFCEA, died at Georgetown University Hospital in Washington on July 9th.

He came to the Association in 1950, bringing to it a broad industrial experience backed by military service which was instrumental in establishing the Association on a firm basis throughout the communications and electronics industry as well as cementing the relationships with the Armed Forces.

Colonel Dixon exemplified the spirit of fellowship upon which the Association is founded, and his unswerving devotion to its objectives resulted in the doubling of the number of members and chapters throughout the United States and overseas.

Born in Worcester, Mass., Colonel Dixon graduated from Worcester Polytechnic Institute in 1912. He began his Army career with the National Guard in 1916 and served in the active Reserve during both World Wars with the Army Signal Corps. Between the wars, he remained a reserve officer in the Signal Corps until his retirement as a Colonel in January 1949. During World War II, he was Chief Signal Officer for the 8th Air Force and Director of Communications for the U. S. Strategic Air Forces in Europe.

His background in the communications field began with the Pacific Telephone and Telegraph Co. in 1912. He continued with the Bell System, in the Western Electric Co. and the New York Telephone Co., until 1929 when he joined the National City Bank of New York where he was in charge of communications until 1940. After World War II, Colonel Dixon was made a vice president of International Telephone & Telegraph Corp. and was regional vice president in Brazil for eighteen months. When in Brazil, he organized the Rio Chapter of the AFCEA and served as its first president. On his return to the United States, he was staff vice president of the IT&T in New York and president of the AFCEA New York Chapter.

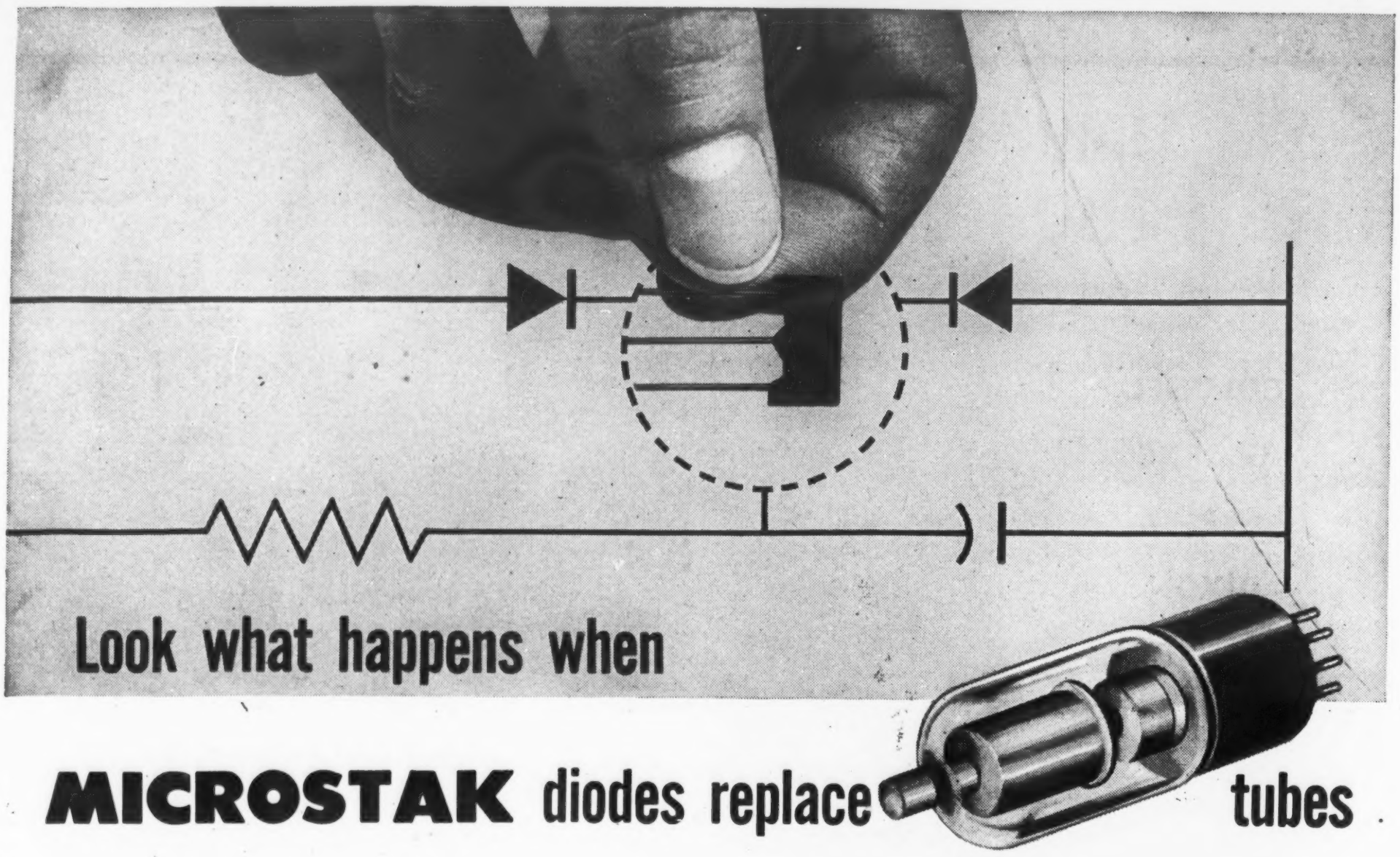
Immediately after his retirement from the IT&T in January 1950, Colonel Dixon was named executive secretary of the then Armed Forces Communications Association and editor of SIGNAL.

For his outstanding military service, Colonel Dixon was awarded many decorations including the Silver Star, the Legion of Merit, Bronze Star and Army Commendation Ribbon. His foreign decorations include Order of the British Empire, Legion of Honor (France), Belgium Croix de Guerre (Gold Star), and French Croix de Guerre (two palms).

Colonel Dixon was a trustee of Worcester Polytechnic Institute from 1936 to 1948 and served as president of its Alumni Association in 1937-39. He was a former president of the Washington Alumni group. He was a member of the Army and Navy Club, a former president of the Greenwich, Conn., Council of the Boy Scouts of America, an honorary member of the French National Academy, a senior member of the Institute of Radio Engineers, and, for many years, a National Commander of the Signal Corps' Veterans Association.

He is survived by his widow, Edna Spitzer Dixon; two daughters, Penelope Ann and Mrs. Richard Haas; one son, Peter A. Dixon, and a sister, Mrs. John W. Bishop. Interment was at Arlington National Cemetery with full military honors.

The passing away of Colonel Dixon removes from the executive office of the Association, as well as from the entire membership, a personality and influence which had broad effect throughout the entire organization. His leadership and ceaseless energy, especially in visiting the Association's many chapters, as well as the constant contact he maintained with industry and the Armed Forces, established for him an enviable record among those who devote their endeavors to the national defense of the United States.



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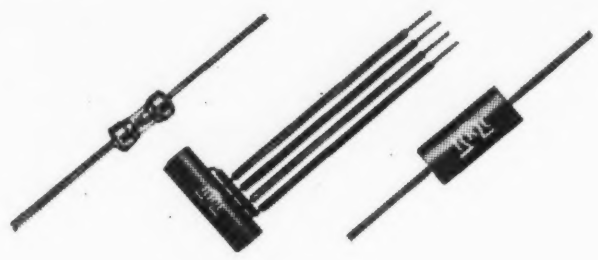

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Report of the 10th Annual AFCEA Convention and Exhibits

Vital Statistics

Dates: May 24-25-26, 1956
Headquarters: Statler Hotel
Host Chapter: Boston, Mass.
Exhibits: 1st Corps Cadet Armory

Theme: Military and Industry: Partners in Progress

Chairman: David R. Hull
Raytheon Manufacturing Co.

Attendance: 1,392
Number of Exhibits: 81

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Secretary of the Air Force

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10th Annual AFCEA Banquet Address by

Donald A. Quarles

Secretary of the Air Force

"Each of us, if we are truly to be Partners in Progress, has much to do to make that partnership fully effective in further strengthening our military and economic position to maintain world peace"

INDIVIDUALLY, AND COLLECTIVELY AS THE ARMED Forces Communications and Electronics Association, your work is of vital importance not only to the Air Force, in which my interests are centered, but, indeed, to the security of the Free World in which we all share a vital interest.

In a personal sense, I am very happy to be here with so many of the friends that I have worked with for more years than I care to recall. As one who has now had an opportunity to serve on both sides of the military-industry partnership that comprises this Armed Forces Communications and Electronics Association, I particularly appreciate the theme of this year's meeting; for each of us, if we are truly to be Partners in Progress, has much to do to make that partnership fully effective in further strengthening our military and economic position to maintain world peace.

In preparing my part in this meeting with you tonight, I tried to anticipate questions you might have raised if this had been a panel-type discussion. I appreciate that our common problems and interests are so broad that I may not be able to touch all of them in the time considered reasonable for an after-dinner speaker, but I assure you that we of the Air Force are anxious to sit down with you, individually or collectively, at any time to resolve our common problems.

At the 10th Annual AFCEA Banquet, outgoing National President George W. Bailey introduces Secretary of the Air Force Donald A. Quarles, featured speaker at the banquet.

Factors in National Security

As a background for the discussion of these more specific matters, I would like to take a few minutes to review the national security situation that confronts us today with particular reference to the area of technology with which this Association is primarily concerned. There are several very important and pressing reasons why we must be preoccupied with technology. Outstanding among these reasons, it seems to me are: first, the revolutionary changes brought about by atomic developments; second, the tremendous advances in transport and communications, and third, the aggressive materialism of Soviet Communism that seeks and threatens to engulf the rest of the world. The first two of these have fundamentally and, insofar as I can see, irreversibly changed our lives. The third would destroy our very way of life if it could.

It was less than 20 years ago that man was able to produce nuclear fission in the laboratory, and it was only a dozen or so years ago that he was first able to make these reactions serve his purposes on a large scale. Unlocking this new door to the storehouse of science has made available to us, and unfortunately to others, explosives roughly a million times more potent, pound for pound, that the chemical explosives previously available.

Concurrently, the development of airplanes and electronic systems of communication, navigation, and control has made neighbors of all the world's peoples. These two, the development of atomic explosives and of very advanced systems of delivering them, have revolutionized concepts of national security. Militarily, the world has shrunk in size to a single battlefield. Instead of being relatively remote and protected from potential aggressors, we now find ourselves in the very center of the fray.

Technology Race Causes Shortages

I believe the basic facts of our technical position vis-a-vis the Soviet Union have been well publicized. We came out of World War II with a very handsome qualitative lead over the Soviets, but we have to admit that they have taken technology very seriously and, as a result of their organization and prime attention to this area, they have made remarkable progress. From a position immediately after the war in which we had at least twice as large a scientific and technical manpower pool as they, they have now pulled up to rough numerical equality with us. Moreover, they are presently adding to this pool at about twice the rate we are. This means that we are now dealing with a very worthy competitor and that our qualitative superiority is being seriously challenged in a technological race for survival.

In this situation, many suggestions have been advanced to get more young people interested in scientific and engineering careers, and to adopt other measures to alleviate the growing shortage of manpower in technical fields. This problem is particularly acute in the electronics industry, as you are well aware. Civilian and military applications of electronics have increased many-fold in the past 10 years, creating a heavy demand for qualified technicians.

There are certain obvious steps which industry can take in the direction of relieving this shortage. *The first is to assure the most effective utilization of technical personnel. The second is to provide formal or on-the-job training to increase the technical proficiency of the personnel. The third is to lend various kinds of support to educational institutions, both secondary schools and colleges, that are the source of supply for technical manpower.* I realize that you are already doing all these things to a very important degree.

Effective utilization of electronic specialists is to some extent guaranteed by the strong competition for technical people. Unfortunately from my standpoint, this competition extends also to personnel in the military establishment. The military are at a disadvantage in this competition because industry is better able to pay our trained men what they are worth. *The inability to retain our skilled people, particularly those trained in operating and maintaining our complex electronic equipment, is perhaps the most serious problem confronting the Air Force* and this in spite of the fact that we have been striving to find a better solution for it by providing pay and other benefits nearly commensurate with the market.

Competitive Nature of Military Electronics

In this connection, I was very much impressed with the suggestion that General Sarnoff advanced in an address before the National Security Industrial Association in Washington early this year; namely, that American industry release a reasonable number of qualified men and women, at full pay for at least a year, to teach such subjects as mathematics, physics, chemistry, engineering, and related subjects in their local schools. He pointed out that such a plan would amount to the "restitution by business of personnel it has siphoned off from the school system," and added further that, "obligation aside, industry would be well advised as a matter of self-interest to help replenish the reservior of trained men and women by stimulating relevant studies at the lower educational levels."

Measures such as these are essential if we are to meet the Soviet challenge to our technical leadership. We have ample evidence that the rapid Soviet progress in technology that I mentioned earlier extends equally to the electronics field. Their organization of electronic countermeasures against our Voice of America broadcasts is a typical example. We have also seen pictures of the radar and communications antennas studded all over the decks of their modern cruisers, with every evidence that they are using advanced electronics in very much the way we are. Their satellite forces showed up in Korea with other advanced forms. Altogether, we must conclude that they have fully recognized the military, as well as civilian, importance of electronics and that they have made progress accordingly.

Sarnoff Recommendation Indorsed

Military electronics is a game of measures, counter-measures and counter counter-measures. So far as I can see, there is no real end to this game. We have a competitive situation where things that are good today may be outmoded tomorrow. This poses a fundamental challenge to the ingenuity and resourcefulness of our industry to meet the competition.

I have no doubt that this discussion raises a question in your minds about the adequacy of our research and development program to meet the technical competition. This is one of the more controversial areas in present-day Air Force planning. Measured by all earlier standards, our present research and development level is certainly very high. Measured in relation to our present-day problems, and perhaps in relation to our competition, there are well informed people who criticize it as being inadequate.

I need not tell this audience that we are dealing here with a very complex and difficult question. One of the complications is that, in addition to some $600 million a year appropriated as Air Force research and development funds, we are using several times this amount in procurement funds for the production and test of development models and the like, all of which, of course, contribute to the research and development program as a whole. This means, however, that the program must be gauged in relation to this total expenditure. Whether this is adequate, and whether it is sound in relation to the research and development potential of the country are matters of judgment.

We in the Air Force are in the process of a detailed study of our program in both the narrow research and development sense and the broader sense embracing related procurement. We recognize that we must be highly selective in the projects we carry out because there simply isn't enough money or talent in the country to do everything that imaginative people can propose, nor even all of the things that would appear to be completely justified. We are, however, fully covering the priority items, such as the strategic missile programs.

I frankly do not feel that we yet have the full answer to this question, but I can assure you that it is receiving earnest study. In the meantime, our 1957 budget should

A panoramic view of convention-goers at the 10th Annual AFCEA Banquet. Standing behind the head-table are (left to right): Capt. S. M. Tucker, USN, Director, Naval Research Laboratory; Percy G. Black, newly-elected AFCEA National President; Brig. Gen. Earle F. Cook, USA, Commanding General, Signal Corps Engineering Laboratories; H. P .Corwith, vice president, Western Union Co.; Maj. Gen. Thomas P. Gerrity, USAF, Asst. for Production Programming, Deputy Chief of Staff/Materiel, USAF; A. A. Farrar, manager, Government Relations, Raytheon Manufacturing Co.; Maj. Gen. James D. O'Connell, USA, Chief Signal Officer, USA; E. N. White, president, New

Secretary Quarles

give us the necessary resources to carry on in the research and development area, at least until we can get a firmer grip of the whole program.

Regardless of the way we answer this particular question, I think it is important to recognize that the Federal Government cannot assume the whole responsibility for this situation and that industry as well as our non-profit research institutions must seek ways and means for independent effective effort to broaden our technical base. I can assure you that we in the Air Force will be sympathetic of such efforts and anxious to find ways to support them within our proper bounds.

Certain Costs Allowed as Overhead

Let us note in this connection that the great bulk of our available Air Force funds are contracted to industries of non-profit research organizations. The exceptions are the funds required within the Air Force for contract administration and technical guidance, for the support and operation of our test facilities, and for a relatively small amount of in-shop investigation. It is also pertinent to note here that Armed Forces procurement regulations authorize us to allow as overhead certain of the costs incurred by a contractor in doing private research and development related to his work on the Government contract.

•

Reliability and Maintainability Problem

Another question that I would no doubt be asked if we were operating on a panel basis would be about the reliability and maintainability of military electronic equipment. I am sure, in fact, that this topic has been emphasized throughout the discussions that have been held here at this meeting. *The tendency for our electronic equipment to become increasingly complex, coupled with the great difficulty the military departments have in getting trained electronic technicians, makes it imperative that we continue the drive to improve the maintainability and reliability of the electronic equipment you produce for the Services.* This is a program that covers a very broad front and that should have a very high priority. It applies to the electronic equipment contractor and to sub-tier contractors, all the way down to the individual components. It emphasizes the importance of the work that is being done in the electron tube and transistor areas of research and development, including the effect of nuclear radiations on such electronic components.

England Telephone & Telegraph Co.; The Honorable Donald A. Quarles, Secretary of the Air Force; David R. Hull, 1956 Convention Chairman; Vice Adm. Edward W. Clexton, USN, Chief of Naval Material; Frederick R. Lack, vice president, Western Electric Co.; Maj. Gen. Gordon A. Blake, USAF, Director of Communications-Electronics, USAF; George W. Bailey, retiring AFCEA National President; Rear Adm. Henry C. Bruton, USN, Director of Naval Communications; Albert E. Mignone, director of research, Arthur D. Little, Inc.; Maj. Gen. Raymond C. Maude, USAF, Commander, Air Force Cambridge Research Center, and Gardiner G. Greene, president, AFCEA Boston Chapter.

In spite of the great improvements that have been made, further increases in the reliability of our equipment and the ease of maintenance could do much to relieve the serious difficulties being experienced by all the Services in training and keeping the kind of men necessary to maintain such equipment. More attention must be given to these less glamorous attributes during the design stages of electronic systems. The Personnel and Training Research Center of the Air Research and Development Command has conducted a number of studies on this problem with our airmen, *the results of which are available to manufacturers.* I think it is obvious that our emphasis on continued technological developments must be paralleled by more effort in the practical aspects of consolidating the technical advances we have already made. The general area of improved reliability offers a broad and fruitful field of endeavor for the inventive talent of industry.

Another somewhat controversial matter that I suspect you would like me to touch on is our weapons system procurement policy. I think we would all agree with the fundamental soundness of the concept that, to be effective, a weapons system must be planned and executed as an intergrated whole rather than as a lot of more or less uncorrelated parts. This plan has always been desirable, but in this day and age of very complicated weapons systems, it has now become imperative.

Ideally, the Government would not only formulate the requirements for such a system but would maintain within the Government laboratories the responsibility for contracting the parts to industry and for their integration into a system. I say "ideally" because such an arrangement would make it possible for the Government to standardize the different elements of the system and thereby assure maximum utilization of each part.

In the post World War II period, the Air Force, confronted as it was with the development of very complex systems of this kind, made the determination that the only effective way it could handle them was to place with large technical organizations the responsibility for integrating these systems, leaving it to this prime contractor to spread the work among subcontractors according to the available know-how.

Sub-Contracting Pattern Established With Prime Contractors

Since our decision to proceed in this way, we have had growing pains. Some of the systems contractors, finding it difficult to get just what they wanted and on just the schedule required, have undertaken to build up

(*Continued on page* 18)

their own organizations in specialized fields, including electronics. This was not the intent of the system as I believe our present practices make clear. While we still feel the need for systems contracting in many areas, we have established with the prime contractors a subcontracting pattern that, in maximum degree, uses the established industries and their available knowhow. Some of the electronics companies are weapons system contractors. Others operate as associate contractors, that is, as prime contractors to the Air Force for the development or production of component equipment to meet specifications prepared by the systems contractor and approved by the Air Force.

We recognize that this is something of a compromise but we believe it is not far from an optimum compromise under present conditions and considering all aspects of the problem.

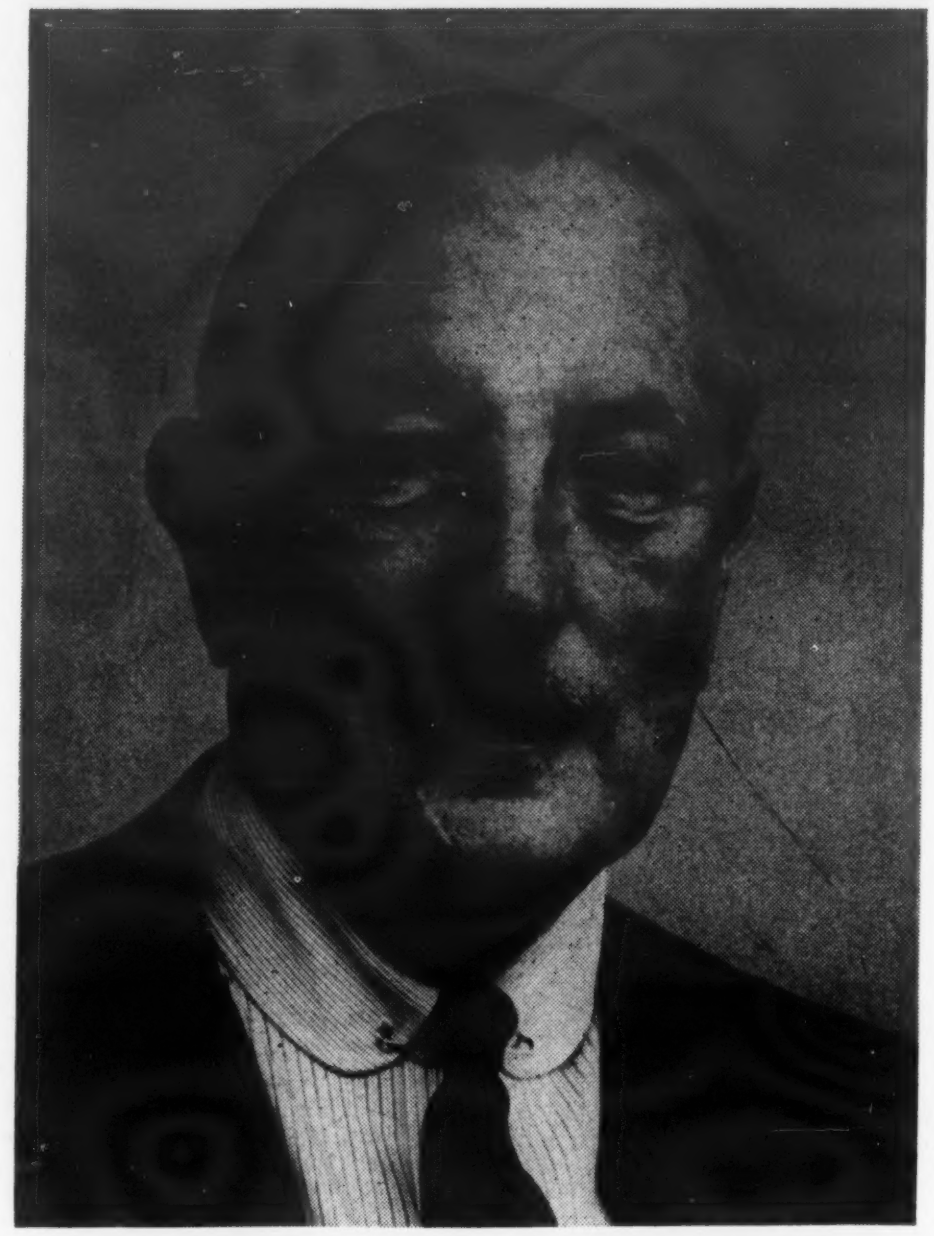
The system can only work well if the systems contractor recognizes that his associate contractors and his first-tier subcontractors must be partners in the contract so that they can make their full contributions to the technical planning and direction of the system. We believe this is well understood and is, in fact, the way the system is now generally working.

Protection of U. S. Interests Abroad

The last major subject I will have time to discuss this evening concerns the measures the Department of Defense and the Air Force, in particular, are taking to protect and further the interests of our electronics industry in respect to our foreign military operations. Primarily, we are relying on Armed Forces procurement regulations and the practices that have been built up under those regulations to assure an equitable treatment of patents and copyrights in respect to proprietary material. We have attempted to so administer these rights as to assure our electronics companies a fair break in respect to their international activities, both in the military and commercial fields. We have not only permitted, but in some instances encouraged, firm-to-firm agreements between our contractors and foreign companies, particularly where those agreements would lead to military activities either here or abroad that would further the security of the Free World.

In respect to Canada, we have a very special situation in which the geography of Canada is particularly important to the security of the United States. Fortunately, we have always enjoyed the most cooperative relationship with the Canadian Government in defense matters. In the agreements with Canada in which we have developed various aspects of continental defense, we have made special arrangements which give full consideration to Canadian companies with a provision that electronic equipment to be installed on Canadian territory be manufactured, in as far as practicable, in Canada. The question of practicability must, in each case, be a matter for consultation between the appropriate Canadian and United States agencies to determine the application of the principle. The factors taken into account include availability in the time period required, as well as cost and performance.

Actually in the PINE TREE system (in which the Canadians bore one-third of the cost), and the DEW-LINE (in which the U.S. is bearing the whole cost), careful consideration has been given in each instance to Canadian companies and their bids. The Canadians,



Newly-elected AFCEA National President Percy G. Black. A 1917 graduate of West Point, he retired from the Army in 1946 with the rank of Colonel. During his military career, Colonel Black served in the Field Artillery in World War I and held various General Staff assignments during World War II. Since his retirement, he has been assistant vice president and Washington representative of Automatic Electric Co. Active in AFCEA affairs, Colonel Black has been a member of the National Board of Directors since 1951, served as president of the Washington Chapter in 1951-52, and was chairman of the 1954 National Convention.

however, have proved quite willing to agree to a U.S. contractor when it was apparent after studies that the U.S. firm was the most favorable bidder. In the case of the MID-CANADA line, which is being financed completely by Canada, many components, for reasons of availability, are being procured from U.S. sources. On the whole, the electronics industries of both countries have profited, and I believe equitably, from these projects.

In this connection, we must not overlook the fact that in the interest of our mutual continental defense, the Canadian Government is making available to our Armed Forces operating rights on their soil, for which we must be duly appreciative.

While I have no doubt there are other matters that we might well discuss, I am afraid I have already tried to cover a lot of ground in a relatively short period. If I have, it is typical of the fast pace of the communications and electronics industry today. As one who spends a good bit of his time reviewing the adequacy of our air power position, I appreciate the very effective partnership between military and industry which this Association typifies. It is a peculiarly American way of tackling our common problems of national security.

In this connection, I think your chapters also deserve special mention as representing a splendid organization for a "grass roots" approach to these matters. Some of the military services' most pressing problems, such as technician shortages, are so wide spread in scope that

they lend themselves admirably to efforts at the local level where practical solutions are apt to be found.

In closing, I want to touch again on our national security situation. Greatly oversimplifying it, one might say that we are in a transition phase— a transition from atomic monopoly to bilateral and perhaps eventually multilateral atomic plenty. This means that, whereas in the past decade we have been able to block Communist exploitation of their armed might by our retaliatory atomic power, the conditions for an effective deterrent position are changing rapidly and to our disadvantage. This is because we have always made it clear that we would not be the aggressor which means, militarily speaking, that we concede to our opponent the first-move advantage. A solid deterrent position under these conditions becomes more difficult and more dangerous. It becomes a precarious balance that could be upset by technological changes, which puts great emphasis on our research and development programs. It makes it all the more important that we adjust international differences and find a more stable basis for an enduring peace; but it makes such a course more treacherous because the dangers of evasion by an aggressor are vastly multiplied.

Necessary Sacrifices for Security

There is, I believe, no ready, easy way out of this situation. This is not to say, however, that we should not devote our best efforts toward working out of it. In the meantime, *the grave danger is that the talk of peace and the smiles from behind the Iron Curtain may delude us into a false sense of security that will result in our relaxing our defensive measures.* If at any time we allow our relative position to sink to a point where an enemy could hope to neutralize our striking power before we could strike back, we will be impotent and at his mercy. Worse, we invite the attack.

The people of this country have always been willing, and in fact determined, to make any necessary sacrifices when national dangers of this kind have been recognized. I believe that, given an understanding of the situation, they are just as willing and determined today. The elementary requirements are: (1) that we accept the challenge and meet it, (2) that we plan and execute our military programs as wisely, realistically, and economically as we can, but with security as the first requirement, and (3) that we pay what it costs as we go rather than charging it up to the account of the next generation by deficit financing.

I have every reason to believe that this Association and in fact all of you who are gathered here this evening agree with this point of view. Speaking for myself, and I believe Secretaries Wilson, Brucker and Thomas would wish me to speak also for them, I want to express warm appreciation for the support you give us in meeting the problems of this dangerous situation and for the great contribution that you individually and collectively make to our national security.

(*Turn to page* 20)

The all-industry exhibits in the 1st Corps Cadet Armory featured during the Convention.

Coming in the next issue of SIGNAL . . .

Our 10TH ANNIVERSARY ISSUE featuring articles from:

- **Top-ranking men in the Services reporting on advances in the military-communications-electronics field during the past ten years.**
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Some of the contributors to this "Big Name" issue will be: Dr. W. R. G. Baker, Dr. Elmer Engstrom, Mr. Walter P. Marshall, and Dr. Daniel Noble.

Forum on Research

- ***Brig. Gen. Earle F. Cook, USA***
  Commanding General
  Signal Corps Engineering Laboratories
  representing *Lt. Gen. James M. Gavin, USA*
  Chief of Research & Development, USA
- ***Rear Adm. Rawson Bennett, USN***
  Chief of Naval Research
- ***Maj. Gen. Herbert B. Thatcher, USAF***
  Asst. Deputy Chief of Staff/Development, USAF
  representing *Lt. Gen. Donald L. Putt, USAF*
  Deputy Chief of Staff/Development, USAF
- ***Mr. Helge Holst***
  Treasurer, Arthur D. Little, Inc.

Brig. Gen. Earle F. Cook, USA

THERE ARE FOUR AREAS OF DISCUSSION WHICH MR. Hull has suggested that this panel explore. These areas are of vital interest to our military contractors and our defense agencies which translate the interpretations into direct tactical and support applications for our national defense.

The first is a point of *distribution philosophy:* how research should be divided efficiently between military laboratories, educational institutions and industrial organizations for maximum return. A very important criterion for this division is capability. It is true that no inflexible rule can be laid down and made to work in every case but there are certain guidelines based on experience which point to our most efficient division.

One is the premise that a military laboratory should do no work that can be done better elsewhere, all other things being equal. You will recognize that last phrase as an ideal escape from the hard and fast. Several factors may influence this equality. For instance, highly secret or sensitive work cannot always be as adequately guarded as in a military installation. The initial stages of research on top-secret weapons involving testing programs, for example, may best be carried forward at installations such as missile bases and our Army Electronic Proving Ground.

Aside from safeguarding our research, there is the question of close cooperation. This is essential between the contractor and our military personnel best acquainted with end-use. Very often, part of the entire research staff working on a given project must be located at the military installation where final development is carried on. This is needed to coordinate efforts of the staff of the industrial contractor with those responsible for the final production.

There are a variety of divisions, however, which may determine industrial placement to advantage. For example, if a final item can be marketed commercially, directly or indirectly, but is being adapted to military use, then major research as well as development should be done on industrial contract. Another clean cut dividing line is this: where an industry has peculiar capabilities which a military institution does not have and cannot economically acquire, then research and development should also go to industry. A further clear dividing line is the case where the military item has no possibility of general public use, and none of its elements contribute materially to the advancement of science. Then research is preferably done at a military installation.

In general, the points we have applied to industry apply to research foundations, even if they are nominally or loosely connected with educational institutions. For example, take Arthur D. Little, Inc., Batelle Memorial Institute and Midwest Research Institute. In the strict sense of the word, these are industrial— even though some of the work is done by part-time faculty members or by graduate students who finance their studies by work for which they receive no academic credit. Ohio State University, Stanford University and California Institute of Technology maintain such research institutions or foundations. A few educational institutions without formal foundations may be so adapted to this activity that they may set up and administer special laboratories which are quite apart from the academic activities of the

(Continued on page 22)

A portion of the head-table at the Keynote Luncheon on May 24th. From left to right: Rear Adm. Roy L. Raney, USCG, Commander, 1st Coast Guard District; Maj. Gen. Raymond C. Maude, USAF, Commander, Air Force Cambridge Research Center; Gardiner G. Greene, president, AFCEA Boston Chapter; Rear Adm. John Snackenberg, USN, Commandant, 1st Naval District Hdqrs.; Lt. Col. George J. Klemm, USA, Commander, Boston Army Base; Helge Holst, treasurer, Arthur D. Little, Inc., and Brig. Gen. Earle F. Cook, Commander, Signal Corps Engineering Laboratories.

THE NET

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institution. Examples of educational institutions supporting this type of activity are Massachusetts Institute of Technology and the University of Michigan.

Strictly educational institutions are in a wholly different class. Their principal functions are to teach and advance human knowledge by basic or fundamental research. With few exceptions, their direction of thought in pursuing defense research should not be influenced, otherwise the natural curiosity of the individual scientist may be curbed and important original concepts and ideas lost. For the most part, it is certainly preferable to keep research at academic institutions *unclassified,* with some exceptions. This permits full coordination between the National Science Foundation and the Department of Defense and other Federal agencies to support unclassified research and is entirely in consonance with the long-established traditions of university research.

It is important, too, that the lead-time in research contracts be substantially long, since a short lead-time by its nature makes a scientist hesitant to attack the more difficult problems where a guarantee of success is not evident in the early stages of the work. The financial support of the gifted scientist should not be determined by a yearly measure of accomplishment, since the truly great advances in science often represent the dedication of many years of a man's life before the results of his work stand out in true perspective.

Let me put these five main points in capsule:

a. The placement of research contracts should be decided by this major factor: highest capability.

b. Liaison with industry is essential. It can be aided by doing a portion of the research within a military installation.

c. Allocation to industry of items with commercial potential.

d. Assign items of highest secrecy and no potential public use to military laboratories.

e. Reserve educational institutions for basic and undirected research pointing toward wholly new concepts and discovery, and furthered by long lead-time.

Channelling of Information

The second item on our agenda is the channelling of research information for maximum end-use. *Here, whenever security permits, findings should be published in our scientific journals and in all other suitable media.*

Classification should be very carefully weighed. It must not be based on timidity, laziness, or fear of making a forthright decision and should not be hindered by slow administrative machinery. It should be based on sound judgment as to whether the project really reveals military secrets or knowledge the enemy does not possess—or is not likely to find out soon.

Another point to consider in classification is this: even if the enemy may pick up new information, its free publication may so advance our own scientific knowledge that this advance offsets any benefits to an enemy.

If the decision to classify is made, the information should have the widest possible need-to-know distribution. This taking advantage of the possibilities of the Research Task Summary is now in effect in the Department of Defense and to a fuller extent in the Army, both directly and through the Armed Services Technical Information Agency (ASTIA). At all times, information should have the lowest possible classification and should be reviewed frequently for downgrading.

Charging Costs to Overhead

The third point on our agenda is the question of *Government support of basic research by a military contractor as overhead cost.* All supporting research, all development, and a good part of production depends on basic knowledge. Much of this was acquired in universities all over the world in previous decades. The United States is only beginning this type of research in comparison with the contributions of older nations. The fact is that we have dissipated capital knowledge and have not adequately replaced it. The military spends fully 40% of the nation's supporting research and development money. By logic, it should support basic research proportionally.

Generally speaking, the cost of supporting basic research by industry should come from profits, or in some instances from specific contracts. *It should not be supported as an overhead charge.* Non-profit institutions,

Brig. Gen. Earle F. Cook, USA
Commanding General, SCEL

Rear Adm. Rawson Bennett, USN
Chief of Naval Research

such as universities, must be considered differently. Contracting for basic research in universities should proceed through contributions in terms of grants or contracts to support basic research in fields preferably chosen by the investigator, although, in many instances, military administrators must influence the field of efforts.

Continued Support of Research

In charging research to overhead, the cost of basic research becomes dependent on the fluctuation of the development program. This is undesirable. Support of research, dollarwise, should be constant or increasing at a rate commensurate with national scientific growth. By full cooperation with the National Science Foundation, or other Federal agencies, the Department of Defense can make sure that *all* fields of science receive as much assistance as the public will authorize by legislation. It makes little difference, however, who pays the bill. The Nation as a whole and the military establishment will benefit, and there is no way of knowing when and how this knowledge may be applied. It is certainly not possible to determine in advance just what research is most likely to pay dividends. It is often the unexpected that becomes of practical importance, particularly in electronics, antibiotics, and nuclear fission.

The fourth point on our agenda is the *protection of*

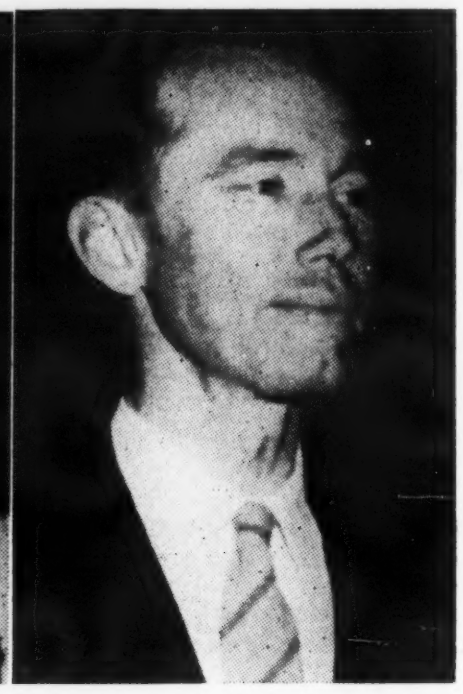
General Cook

proprietary rights. This protection must be administered within the framework of two factors providing justice to all Government contractors and, at the same time, assuring that the national welfare is considered.

A discovery with commercial value, stemming from research in a military laboratory should become fully available to industry and the public. Such an efficient flow is now in effect through the Office of Technical Services of the Department of Commerce, and a sizeable portion of the military research dollar is returned to the taxpayer through this office. This presents no problem to the Government.

When a discovery of commercial value is made by industry or a research foundation, it introduces a question of proprietary rights. These depend entirely upon circumstances and conditions. If paid for entirely by military money, the discovery is the property of the Government. Here again, once this determination has been made, no further problem exists.

Maj. Gen. Herbert B. Thatcher, USAF, Asst. Deputy Chief of Staff/Development, USAF



Mr. Helge Holst
Treasurer
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If the military is given first rights to utilize a discovery made by an industry at its own expense, the proprietary rights of its discoverer must be safeguarded. When such discoveries have positive commercial values, they pose a serious problem to the Government. On the one hand, for national defense purposes, it would be of much benefit if such information could be disseminated throughout industry in order to strengthen this defense. This is particularly true in the atomic age where dispersal of information becomes at least as important as dispersal of our manufacturing facilities. On the other hand, it is much to the advantage of industry to maintain the privacy of such information.

The solution to this problem lies largely in industry's hands. The best national interest would be served by the patriotic gift by industry of its acquired knowledge, in some cases. This, admittedly, may decrease the individual industrial organization's own competitive position but, in turn, will add to our national structure as a whole. It is gratifying to see more of our organizations engaged in research and development taking this latter position in recent years, in many cases greatly strengthening our elements of national defense.

Rear Adm. Rawson Bennett, USN

THE NAVY APPROACH TO RESEARCH AND DEVELOPMENT has always placed heavy emphasis on basic work. We feel that we have a responsibility for helping to maintain a strong science in this country. After World War 11, the Office of Naval Research had no hesitation in helping to rebuild university science. This was not altruism or charity; it was common sense. It was an investment, and the Navy has been repaid for this foresight many times over. The ships, aircraft, missiles, and electronics gear that we have been developing these past few years are to a large extent the children of post-war research.

We cannot have real progress without new knowledge. This is at the heart of our attitude toward basic science, but other factors enter into it, too. The scientists doing basic work are among the most able and imaginative in the country. In addition to advancing science, they have been a ready reserve for speeding up military technology in an emergency. They have contributed some brilliant new ideas to broad warfare areas, as well.

Another reason is education. The scientists and engineers we will need in the future can only be trained through basic science carried on in the universities.

Basic science in relevant fields has an important place in applied scientific laboratories. Besides helping to fill gaps in knowledge, it helps attract new scientists. It stimulates imagination and, in general, adds to the intangible laboratory spirit that can be the difference between a good and a mediocre laboratory.

I mention this by way of background to the entire Navy research and development program. *We want to have a "defense in depth" against obsolescence and stagnant technology.*

Our work in the electronics field is typical of this approach. The more fundamental phase of the program is represented by projects in physical electronics and electronic circuits and systems. The physical electronics research is concerned with both theoretical and experimental analyses of the fundamental behavior of elementary particles.

Research on Systems Components

In systems research, we emphasized work that will help formulate systems and synthesis. It is a viewpoint that includes both the men and the machines and is aiming to provide for efficient use of men in an over-all system. Specifically, we are continuing research on systems components, especially electronic digital components, and in the application of digital computers to specific military problems. The broad progress in communications theory and circuits has been important to military applications.

To get the improved components we need to take full advantage of advances in circuit design, we have a large contract program and a substantial program at the Naval Research Laboratory. Most of ONR's basic research has always been performed under contract. This is still the case. All told, ONR has contracts with nearly 200 universities and other non-profit research institutions and with approximately the same number of commercial

(*Continued on page* 25)

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firms. About four-fifths of our basic research is by contract. Considering the entire Navy research and development program, we estimate that about forty per cent of the funds will be spent in Naval and other Government laboratories and about sixty per cent in the industrial economy. We feel that this is a reasonably sound ratio.

Several factors enter into an appraisal of what proportion of our work should be done in our laboratories. There are some rather obvious, broad guidelines to be followed. First, regardless, of the percentage distribution of the work, we feel that the workload of a laboratory should remain relatively constant. Violent ups and downs in the budget from year to year would mean expansion and contraction of personnel; it would mean unused facilities during the lean periods; it would promote a general feeling of instability and restlessness that is fatal to productive research. So we try to plan for stable programs in the Navy laboratories.

Second, the nature of the work itself naturally has a bearing on where it should be done. In general, the Naval Research Laboratory and the other Navy laboratories perform work that requires considerable Naval background, and often the use of facilities that are unique to the Navy.

In certain fields there must be an intimate connection with the sea, the ships, and the electronic equipment that is the end product. At one of our laboratories, the engineering staff put in more than 40,000 man-hours aboard naval vessels at sea during one year. We have developed a group of sea-going civilian scientists at that laboratory. *They are men who know the Navy and its problems because they have a close daily association with them. This is a unique resource that is not available to us in any single industrial laboratory.* Many other examples could be given of fields of effort closely associated with the sea and ships.

Broad and Balanced Research Projects

Another reason is that we feel that our research and development laboratories, if they are to be good, effective laboratories, need to have broad programs. They need the full range of research and development functions. We want to attract good men to make scientific careers in the Navy research organization. The most satisfying compensation we can offer such men is the opportunity to take part in technical programs with breadth and significance, programs with professional and scientific challenge. This factor of challenging work is one of the strongest inducements the Government can offer to professional people. Most of our top men could make more money and enjoy additional fringe benefits elsewhere than in Government service.

We know from experience that we can attract good men if the programs of our laboratories are broad enough in scope, and if there is a desirable balance among the functions performed. There should be a balance among applied research, development and design, engineering evaluation, equipment tests, and technical advisory services to our contractors and to the Navy Bureaus. This is another of the factors that shapes our attitude toward distribution of our research work.

Our basic research and applied research programs generate tremendous amounts of information. This is their purpose. We want the information so we can use it in our development programs. In a research program of such great breadth, the matter of getting the information to the man who can use it is obviously a problem in itself.

To accomplish this, we use every means available to us. The ONR operation has always been based on a philosophy of bringing working people together as often as possible for the exchange of information. We believe in the greatest amount of person to person contact, as the most effective means of passing on technical information and ideas.

The personnel in each of ONR's internal branches have many contacts throughout the Navy Bureaus and are familiar with their programs. They are in day-to-day contact. This continual working-level association is the heart of our technical information network.

We sponsor many symposiums, especially in classified areas. The purpose of these symposiums is to bring people together, to present their own papers and listen to papers by their colleagues, to discuss their ideas and, in general, keep up to date on what is going on in other branches of their field. This helps to spark personal contacts, and it promotes the cross-fertilization of ideas that comes from contact with many different scientific disciplines and engineering fields dealing with the same military problem.

Importance of Technical Reports

Another internal means we use to round up new information and channel it for effective use is the study and critique of what we know. These surveys of the work going on in a given area help pull together all the odds and ends of information that have bearing on an operational or technical problem. The large-scale warfare study is essentially an expansion of this technique. It helps to line up the many aspects of a problem and the relevant information, so that we know what is possible in the way of a solution, or at least in its approach.

The end product of our scientific research programs, of course, is technical reports. They contain the results of the research, the specific data we want to pass on to those doing the development work. The Department of Defense generates more than 50,000 technical reports every year as a result of its research and development programs.

The big problem is, how can we let people know of the existence of each report? How does the man in the Bureau or in the contractor's plant have access to these reports?

In the case of unclassified scientific research, the open literature serves as a medium for getting new information to the scientist. ONR contractors are encouraged to publish their findings, and we are very concerned that this is done. We *want* ONR-sponsored research results disseminated throughout the scientific world. About a year ago, we had a survey made to determine if our work was getting into the scientific literature, and the results were gratifying. We found that at least 85% of our unclassified research does appear in the open literature, although this is usually later than its appearance in a technical report. Since the other 15% consists largely of bits of pieces of research culled out by the scientist for purposes of a finished paper, but still useful to us, we feel we can say that virtually all of the published work does appear in open print. In the classified areas, we rely heavily on the Armed Services Technical Information Agency.

(*Continued on page* 26)

Admiral Bennett

For passing on the work within the Navy, we, of course, have our own distribution system. Each contract that results in a technical report not appearing in the open literature is covered by a distribution list that will get it to nearly everyone in the Navy with an interest in the report.

Operations research type reports, for example, are generally highly classified, yet should receive the widest distribution permitted by their classification. Their primary circulation is within the Fleet and the Chief of Naval Operations. The people responsible for a given operations research report draw up their own distribution list, which is then sent to the Chief of Naval Operations for checking to see that all the Fleet commands who should receive this report will get it.

After accepting the AFCEA Annual Chapter of the Year Award for the North Texas Chapter, Howard L. Housley, former president of the chapter, presented George W. Bailey a "Texas-sized" gavel in recognition of his work as prsident of the Association for the past two years.

This problem of getting research results into the development mill is one of many corollary areas that a Federal research agency has to think about. Another is the problem of financing the conduct of research, since we are buying something very different from the commodities for which most Government procurement regulations were written. In basic research, especially, we don't know in advance what we are going to get. In many cases all we are doing is renting somebody's brain for a while. In the case of industrial contractors, we may be buying development work in which the contractor has invested a lot of basic research of his own.

Reasonableness as a Yardstick

The Navy has long recognized that basic research performed by a contractor in connection with development or applied research contracts can be considered a legitimate cost in computing overhead costs in a contract. The extent to which this can be done is a factor of many different circumstances, of course, because of the wide variation in contracts and contractors. *In practice, Navy procuring activities have generally allowed basic research expenses as part of overhead to the extent that a showing is made that the Navy would benefit either directly or indirectly by the contractor's efforts.*

Many factors have to be considered when we determine whether to put a special provision in a contract that would provide for reimbursement of general research costs. First, is the scope, the nature, and the quality of the contractor's independent general research program. Is it likely to be of benefit to the work being performed under the research contract? Also, we must consider what benefits may accrue to the Government under such a provision, in the way of reports, royalty-free licenses, and similar considerations. Other factors to be considered are a comparison of size and cost of the contractor's independent research programs of previous years, and the proportion of Government business to total business.

In general, we try to use reasonableness as our yardstick, in the light of the technical size and scope of the contractor's general research program.

Another knotty problem that arises in many research and development contracts with industry is the matter of proprietary rights. Stated as simply as possible, the horns of this dilemma are that the Government's interest would be best served if it had unrestricted use of all information growing out of a research and development contract, while the contractor doesn't want to make his proprietary information available to competitors through Government channels.

A proposed revision of the Armed Services Procurement Regulation relating to this problem is now in the mill. It is the result of more than four years of discussion and study. In this revision the Government maintains the position that when it asks for a prototype in a development contract, it wants all the information originated in the course of the development, including background information.

This draft is now being circulated throughout industry for comment. The response so far indicates that an ideal solution has not yet been reached, to say the least.

Maj. Gen. Herbert B. Thatcher, USAF

A GREAT DEAL HAS BEEN SAID IN RECENT MONTHS concerning the growth of Soviet industry and the narrowing of our margin of technical superiority which heretofore we rather smugly enjoyed. I believe these statements are prompted more by noted engine and air frame development and developments in the nuclear field rather than by known advances in the electronics field. There is no reason to suppose, however, that the same is not true in the area of electronics and communications as in the other areas. Likewise, a great deal has been published recently, concerning the rapid rate of advance and the huge numbers of trained engineers being graduated from Soviet universities. This number,

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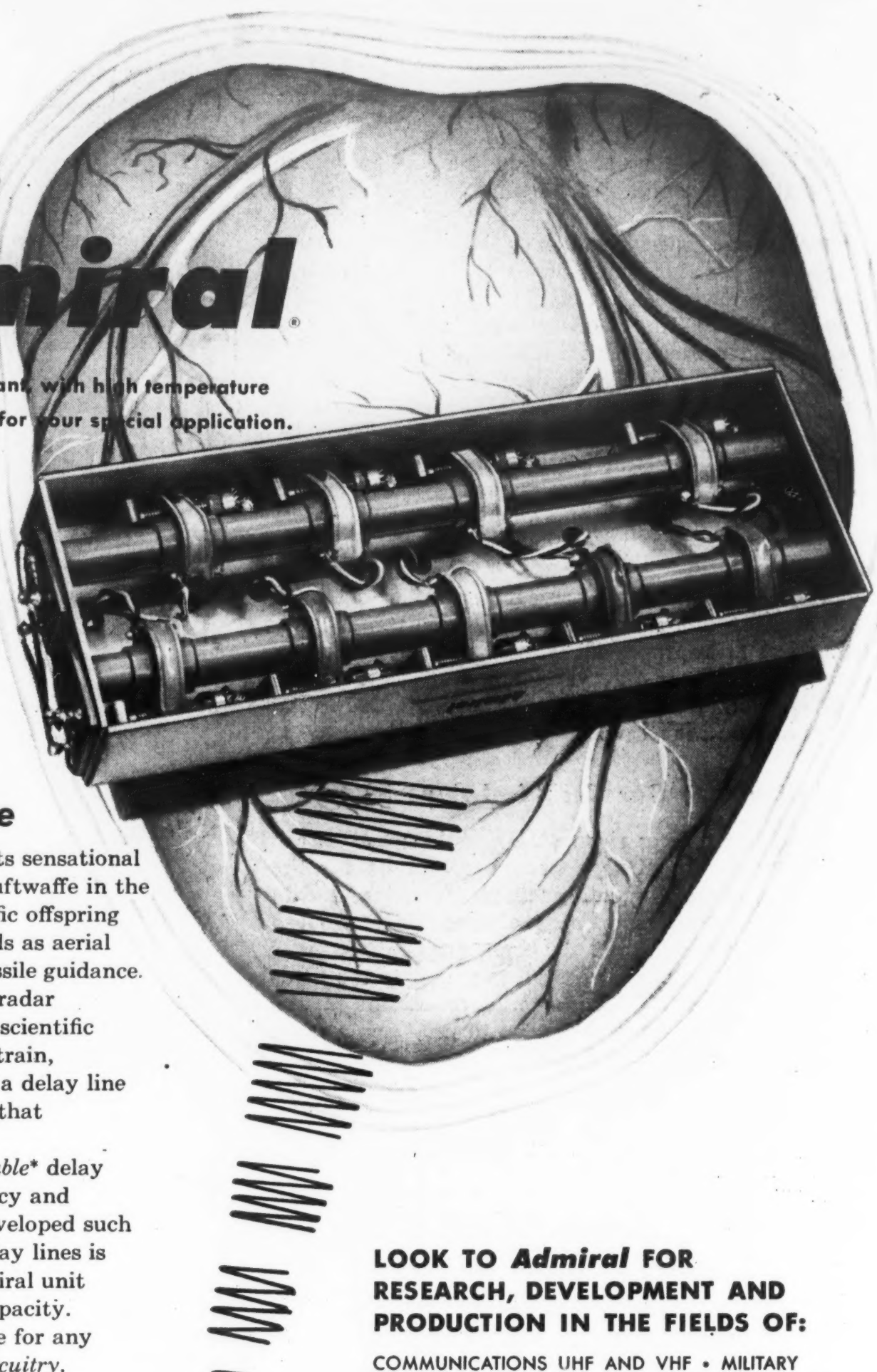

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Scarcely fifteen years ago radar made its sensational debut when it helped defeat Hitler's Luftwaffe in the Battle of Britain. Since then its scientific offspring have become commonplace in such fields as aerial navigation, interrogation (IFF) and missile guidance.

All these elaborations of the basic radar principle, and many others now on the scientific horizon, depend on an electronic pulse train, established and controlled by means of a delay line . . . the very *heart* of the apparatus . . . that determines its scope and usefulness.

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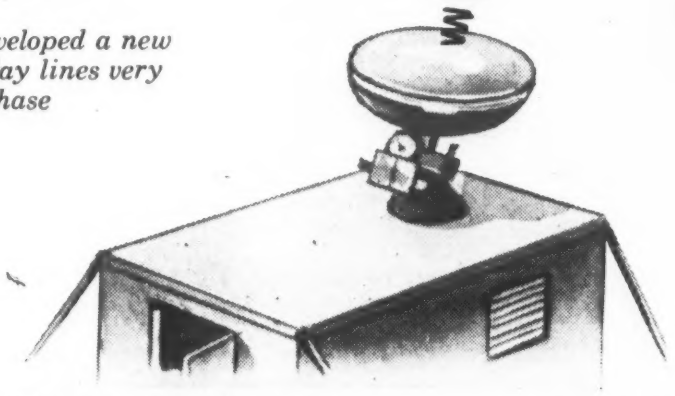

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I believe, has more than doubled in the last ten years surpassing the number of the United States institutional graduates.

A similar area of speculation as to technical supremacy came about several years ago when the Soviets fired a hydrogen type device. This, again, gave rise to much speculation as to just how seriously our technical superiority was being matched. . . .

In the area of electronics over the last five or six years, the success of the Voice of America program has been somewhat challenged by rather effective electronic countermeasures, the characteristics of which, I believe, rather surprised our electronic engineers.

We have all seen the pictures of Soviet naval vessels and noted the modern type radar antennas carried in quantity.

Not a single May Day in recent years has occurred without at least one new design of aircraft being exhibited. First turboprops, advanced fighters, then turbojet bombers, and now this year, a new fighter. There may be many other things which are not exhibited to the general public on May Day.

Challenge to Our Technical Superiority

All of the above gives rise to the question: "What are we doing about it?" One approach might be for the Federal Government to greatly increase its budget and to greatly increase the Department of Defense sponsored control of the research and development field, to offer Federal scholarships or, in general, to proselyte the fields of industry for DOD efforts and to make captive customers out of our large industrial firms. Such a move is certainly not in keeping with the ideals of democracy, and we might well find ourselves employing the very tactics against which we are fighting.

The truth is that I do not believe we should be surprised that our technical superiority is being challenged. Wherever sufficient effort is placed in any particular field, it is possible with increasing emphasis to temporarily equal or possibly surpass those which follow a more normal trend. Although it is very wrong for a military man to underestimate an enemy—in truth the first axiom in making an estimate of the situation is to credit the enemy with doing the smart thing and with having the same capabilities as you possess — the fact that we suddenly seem to have realized these significant trends among the Soviets should not be surprising to us.

I believe the important thing to remember is our desire to make workable, efficient and maintainable equipment which, when properly employed can perform our mission at all costs. If one man suddenly built a round mousetrap, this does not mean we should discard the square one unless it can no longer catch mice. Just because a new invention appears on the horizon it does not necessarily follow that we should discard all other systems, unless the significant improvements in operation make it more reliable or necessary to counter enemy advances.

I believe the greatest field for invention today, and particularly in the electronics industry, is in the area of reliability. Perhaps the weakest link, now, in our system from supplier to bombs on a target is the reliability now enjoyed by our various electronic systems. In many of our present weapons systems we have at least several electronic components, and the reliability of the weapons systems depreciates in accordance with the products of each. The reliability of 5 components each with a reliability of 95% gives a system a reliability of only 76%. Our components must work the first time, and we must be in the position to adopt the attitude, "I works, don't fix it," rather than, "Fix it so that it will work."

Daily there appear to be hundreds of incidences where by faulty and unreliable equipment causes a mission to be unsuccessful, a guided missile to fail, or a fire control system to miscalculate. I question very much whether the Soviets enjoy any better reliability than we do, if as good, and thus in spite of the advances in technology which we have observed, I repeat that the greatest field of endeavor for American science is to improve the reliability and the maintainability of our equipment.

Buy the Talent Wherever It Lies

I think all of you here are familiar with the Air Force method of conducting research and development, particularly in the field of electronics. Very little of our effort is expended in our own laboratories and a very small percentage of our funds remain in the Air Force. The figure is so small as not even to be worthy of mention. The great bulk of our expenditures are with industry or educational institutions. We have no ironclad rule as to where and how to distribute our dollars between firms and institutions, but we believe in *buying research wherever the talent lies to meet our problem.* Past examples, however, prove that we do a very large share with both industry and institutions. This is in the so-called area of direct contract.

In addition to direct contracts, I believe everyone here is familiar with the Armed Forces procurement regulations which authorize a portion of the R & D to be properly chargeable as an overhead cost. This is more true in electronics than it is in other areas of development. Past experience in this field has been rather significant and, in addition, the Government does provide certain authorizations that R & D expenditures are allowable deductions from corporation income taxes. Utilizing these practices, we should like to see industry enlarge its R & D activities, and we have taken certain steps to advise industry as to the areas in which we are most interested. There have been numerous symposiums held at Headquarters, Air Research and Development Command and the Cambridge Research Center to inform industry as to our technical program directives. Many of these we cannot fund ourselves due to priority of other items, but they should give a clear indication to industry as to proper areas of probable marketable items.

A.F. Support of Technical Associations

In addition to this, we have made special efforts to channel our research information so as to be made available to all those working in a common field. The Air Force has always sponsored and supported various technical societies such as this one, the IAS, the Institute of Radio Engineers and others. Written into each contract as a piece of boiler plate is the authorization for the contractor to furnish material for the various technical trade journals, provided that the proper security cautions are maintained. We have made wide use of dissemination of information through the Armed Services Technical Information Agency in classified and unclassified areas.

In our efforts to spread technical information, we must, of course, protect the proprietary interests should this

(*Continued on page* 30)

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General Thatcher

point raise its head. I believe it is a correct statement to say the Air Force is not interested in securing for the Government any specific proprietary rights, and certainly is interested in maintaining for U. S. contractors their proprietary rights in relation to foreign efforts. Should the Air Force own a piece of information, however, I believe you are all familiar that for defensive purposes it may authorize the use of this information in any way to further the defense effort. There are many examples of this. For example, when the Air Force asked the Douglas Aircraft Corporation to produce the Boeing B-17 we provided Douglas with complete drawings, blueprints, stress analyses, etc. If there is a commercial application involved, the Air Force usually specifies in its contract the protection of the proprietary rights of the inventor when such is involved. . . .

We, in the Air Force, believe that we have a healthy program and one which stimulates competition and acts as a catalyst on the inventive talent of industry. We believe that the present efforts to stimulate industry are

David R. Hull, Convention Chairman, presents an award certificate to Joseph E. Heinrich, director of the Fort Monmouth Chapter at the banquet. The Fort Monmouth Chapter received this award for enrolling the largest number of new members during the 1955-56 Chapter of the Year contest. Donald A. Quarles is in foreground.

in keeping with our national ideals of democracy, and that we are not infringing upon prerogatives or making captive customers out of our organizations. We believe we have provided the way and the means to show industry where we are going, where we should like to go, what our requirements are, and it would appear that there are many advantages to be gained by industry doing more than it has in the past with their own dollars.

I do not mean to single out the electronics industry in this respect. It is merely that its application in this area is certainly present. Neither do I mean to be derogatory regarding your past efforts. On the contrary, the overall success of our total defense effort hinges more and more on advances or new scientific developments in electronics and communications equipment.

I do say that there is a new challenge which I think many have known for a long time but which suddenly has achieved national prominence. That is the Soviet technical advance. I, for one, am certainly not fearful that our industrial and educational institutions cannot combine effectively and deliver the goods to do the job. *I am also firmly convinced that this for the most part must remain free and unfettered by Government control.* It must continue to enjoy a mutual responsibility and must have a wholehearted and enthusiastic support, one to the other.

Mr. Helge Holst

THE FIRST TOPIC TO BE DISCUSSED, AS I INTERPRET IT, is how in the best interests of national defense should research projects be divided or distributed among Government laboratories, educational institutions, and organizations called industrial laboratories. You have heard each of the speakers speak on this subject. Let's try a somewhat different approach.

First of all, the speakers have all said in effect—and especially General Thatcher—that the problems of keeping our Services ahead, if possible, but certainly abreast of potential enemies are so many and so difficult, that the more capable talent devoted to this effort the better. Surely we can all see that in the interests of efficiency, if we can get talent devoted to these problems (and remember that they are by no means all the problems of the economy, for we have to remain alive and fed and clothed as well) it would seem to be in the interests of effectiveness and efficiency to use that talent wherever it now is, in the environment in which it has already proven that it is effective. . . . So it is not only a question of finding talent that will work on the problems, but of keeping it in an environment—both the physical environment and the financial environment—in which it has proven it can be effective, and in which it presumably can be counted on to continue to be effective. . . .

It would seem to me, as has been said by Admiral Bennett, that the military laboratories can probably do best that part of the research and development effort which is particularly concerned with the final stages of making a new projectile or weapon or an armament system best adapted to military field, ocean, or air use.

Military vs. Educational Laboratories

The military laboratories are closest to the test areas, and the using Services. They are staffed in part with people from the Services. So it would seem only logical that the final stages of perfecting new developments as military tools would best be done by the military laboratories. Perhaps highly-classified applications should also be carried out in military laboratories, although I don't necessarily agree with that. It seems to me that the problems of security are only a part of the problem and need not be controlling.

I would like to pay tribute to the Office of Naval Research for their backing of basic research. ONR has been outstanding in this respect, even when Congress was against spending Government money for anything except strictly applied research. Through some divine wisdom, or stubbornness—I don't know which it was—the Office of Naval Research insisted on investing in new knowledge and additional trained scientists and engineers even though there appeared to be no immediate, tangible re-

sults at the time. Congressmen usually don't buy that way! We have heard how much the resulting knowledge and personnel have contributed to present weapons.

Basic research of a fairly general character is on the other end of the scale from the final development of military items. Where there is no particular urgency, but rather a great desire to gather information and to use curiosity, this kind of research lends itself to being done in academic institutions. This is particularly true of the work that is not classified.

Do not forget, however, that the primary job of our educational institutions is to educate, not to do research. In this connection, this means not to accomplish specific military objectives, but to educate. And this is important to all of us, because it is from these educational institutions that we are all hoping to get technical and other trained personnel, and if research programs are allowed to interfere with education, this is going to hurt us all. Moreover, the personnel available to do research in educational institutions are generally the younger people. There are, of course, some graybeards among the faculty, but the staffs of the projects are likely to be undergraduates. These are relatively untrained. Usually they are not put through the security clearance. . . .

Therefore, educational institutions, in general, are best suited to doing work of a non-urgent character, and work which lends itself to being used as an aid to teaching—usually unclassified work. For crash programs, the educational institutions are not generally suitable, and, in general, it shouldn't be expected that they would be. Making final refinements in a project is not usually useful for educational purposes. Such work is, therefore, inconsistent with the primary objectives of the educational institution.

The Industrial Laboratory

Now, having disposed of the military laboratories and the educational laboratories, and myself coming from an industrial laboratory, what have *we* to offer? What are we suited for? Why the entire field, of course! There is no question about it!

Industrial laboratories should be thought of in essentially two categories (a) those laboratories which are immediately tied to production organizations, and (b) those laboratories which are not themselves production organizations but are purely research institutions. . . .

Laboratories associated with production organizations must, of necessity, devote most of their time and talent to those projects which will ultimately give rise to production. They exist to feed the production arms of the business. There is nothing wrong with this. This kind of laboratory is, I think, best suited to develop items which will be materially influenced by productive know-how. These would frequently be urgent programs which look as if they are primarily production problems rather than military research and development problems. Such work is probably best done in industrial laboratories where the laboratory is closely associated with a production organization.

In contrast to captive industrial research laboratories, in an industrial laboratory which is not related to a production organization or to manufacturing processes, you can get impartial advice over a broad field. You can get development recommendations which are independent of particular productive techniques. It is immaterial to such a laboratory whether the things are made of forgings, machinings, stampings, or what-not.

S. H. Simpson, president of the South Texas Chapter, accepts an award certificate from David R. Hull. It was presented to this chapter for holding the maximum number of chapter meetings during the contest year. A similar certificate in this category was also awarded to the Augusta-Fort Gordon Chapter.

Moreover, in general, you can expect to find in the independent laboratory a wider range of competence because it normally operates over wider fields—not just electronics or just ceramics and so on—with a greater degree of independence of particular types of products or techniques of production. And you can expect to find, in general, a fairly broad acquaintance with a wide panorama of techniques and an industrial clientele whose techniques can furnish a broad range of concepts.

So it seems to me that there is something to be said for considering that the best distribution of research effort should be determined, in general, by such features as: (1) Is the project primarily a military application requiring extensive acquaintance with military use? (2) Is it primarily basic and unclassified? (3) Or is it somewhere in between where production and urgency and the ability to use mature personnel is a primary consideration? None of these criteria will immediately and conclusively answer any question, but they are material considerations in selecting a promising location for a research project. Of course, in all instances, *real competence of staff is assumed to exist—for brains, rather than facilities, is the real heart of research.*

Distribution of Information

The next topic that we were asked to discuss, which naturally has been touched on by the other speakers, is: *How can research information be most effectively distributed or communicated to help national defense? . . .*

The question of how to make effective use of the vast flow of technical finding is a baffling problem, and it hasn't been solved. Various means are being tried, and it may be of interest for you to know the nature of these approaches. You all know that Dr. Vannevar Bush, former chairman of the Carnegie Foundation, and others have conceived of equipment which would scan printed pages very rapidly and upon coming across certain phrases, such as "high explosive," would spot the page and pick it out. Then, some research worker, or probably some screening librarian, would cull over the pages to see if they were pertinent. In another approach code words are placed in the margins of printed material and the sorting is based on detection of those words.

(*Continued on page* 32)

Mr. Holst

In our own company, under the sponsorship of the Ordnance Department, we have been trying another approach, and this has been to take published information —in our case, the field of explosives—and go through it, trying to reduce the content of the information to certain code phrases or code digits and then put this coded information on punch cards or magnetic tapes. In this form the data is readily scanned by a worker searching a particular area, who can, therefore, quickly find what has been written and published.

A vast amount of research information is being published. But this does not automatically mean that the data is used—only that it is open to the public. The question is how you can easily and quickly get at what has been published, not just currently through the last few issues, but over a long period of time. How can workers investigate this information so quickly and easily that they can afford to become acquainted with what has been published within the time and cost budget under which they are working?

We want our scientists and engineers to take a look at what has been done rather than to do it over again. There is actually a vast amount of re-doing of work even within a single organization—even within the finest and most efficient organizations of the country. Scientists have told me themselves that they know they re-do work several times because what has been done in one area is not known to other personnel. The information from over here doesn't get over there. So the new workers don't know about it, either because they don't use the library, or the library does not readily produce the information.

Just how should you transmit the information that is being accumulated? What data will be most useful? These are very difficult problems. Symposiums, get-togethers, having the senior staff exchange information, having the juniors drink coffee together — these all help. These are all techniques. No one has found the perfect answer yet. The field is still being worked on.

Sponsoring of Basic Research

The third topic is Government support of basic research by military contractors not engaged to work in the field of research. Since there would be no direct contract for the work, support of any would be through overhead cost. Please note the distinction between basic research which is sponsored by the Government—the type on which ONR has done such a magnificent job—and basic research which is not sponsored by the Government. Admiral Bennett has told you how much the Office of Naval Research is doing in the field of sponsored basic research. There are corresponding agencies younger in time and in experience in the Army, at Duke University, and in the Air Force at Baltimore, pushing away at sponsored basic research, generally done outside of their own organizations. The area of support for unsponsored research is decidedly a less happy one.

If it is agreed—and I think it is—that basic research is very desirable in the interest of the nation and of the Armed Services, then the important and interesting question, it seems to me, is how can the Government and the Armed Services effectively support such unsponsored basic research. As has been mentioned before, not everybody in the country is engaged in military research. However, the more competent talent that can be enlisted the better. The question is, however, how to arrange optimum support.

Moreover, while you cannot tell in advance where basic research is going to lead—and this is something I wish my military listeners would pay particular attention to—*it is almost certain that it is the military who will use the results of the basic research first, no matter where it comes from.* New knowledge and new techniques which enlarge the properties of materials, no matter whether it is greater stretchability of plastics, or the ability of plastics not to become brittle at low temperatures, to have sharper cutting edges, and have them longer, and so on, will usually be first applied for the military.

Since it is military activities which call for operating under extremes of climatic conditions and extremes of service life, and so on, it follows that whatever is learned from basic science which extends useful knowledge and useful properties will in nearly every case be used first by the military. And it seems to me that the military should be grateful and—more than grateful—generous in supporting research workers anywhere in the contracting organizations who have the curiosity, the talent, and the ability to do basic research. Moreover, such support will be only on a shared or reduced cost basis.

Government Should Pay Its Share

But this point of view and this practice are not always the case. This is because the Armed Services Procurement Regulation, which is the Bible as to reimbursability of costs, in general, provides that the military will pay for research which relates to its own projects and will, in general, be unwilling to pay for other basic research. This is sometimes qualified, when, as has been said by some of the other speakers, the research would appear to have usefulness to the military. But this often cannot be shown for truly basic research.

It would seem that this negative point of view is undesirable for two basic reasons. First, as I have said, because you cannot really tell who is going to benefit from basic research, but especially because there is a very great likelihood that the military will benefit first. In the case of our own organization, we have been able to show that when we have been curious about infrared, or extremities of low temperatures, or any of these things, it has always been the military that has first needed items derived from such basic research.

So it seems to me that it is in the interest of the Services, purely from a selfish point of view, to help support basic research. By this means, they enlist people in basic research effort who are not available under direct contract. This is accomplished just through acceptance of basic research cost as a permissible overhead cost, of which the Government will, of course, pay its share.

But there is another—and more strictly accounting—reason why it seems to me that the Government should share in basic research costs. It is this: If basic research is a desirable and necessary means for industry to keep pushing forward its frontiers of knowledge and skill; if it is a generally useful and reasonable cost of keeping industry moving forward, and educational institutions moving forward—it does not matter which—then it seems to me, as with any other basic and reasonable and necessary indirect cost, that the cost of basic research should be accepted as proper overhead. But the regulations—at least, the basic regulations—are to the contrary. . . .

(*Continued on page* 35)

Mr. Holst

The fourth subject is the protection of proprietary rights. Like any of the three other points, this could receive full-scale treatment in itself, and at the end of such treatment you would not have complete answers. But it is hoped that you would have some light. It is not an easy question to answer, because, as has been said before, you have here a mixed situation.

If the military sponsors a project, obviously they are entitled to the results of the project. But what happens in a case where you enlist a contractor who is already pre-eminent in that field and in doing so employ his proprietary knowhow? Should that contractor take a Government contract if it is going to imperil his competitive position in industry?

Now, I am not asking purely theoretical questions whether he should or should not, or why he does or does not. Let me give a specific example: Suppose that a company is particularly good at something . . . and that this something that they are theoretically good at is in some way related to the field of interest of the military. The military wants to enlist this specially qualified contractor because he has particular knowhow that is related to the field of interest of the military. But let us assume this particular knowhow is used throughout this contractor's regular commercial line.

Now—without any denial whatever that the Government is entitled to buy what it wishes, and that whatever it buys it is entitled to have—what is the Government buying? Is it buying just the hardware? Is it buying the production knowhow? Is it buying trade secrets? What is it buying?

Middle Road Should Be Sought

Under these conditions, if the foregoing questions are not clarified, is it best for our imaginary contractor to stay out of this field and not risk his own proprietary rights? If the contractor decides to stay out of this field because of some Governmental policy or other, is that in the interest of national defense? Is it desirable that a particularly qualified contractor refrain from participating in national defense?

Do you want the *most qualified* contractor, who happens to have some proprietary rights; or do you want the *least qualified* contractor, because he has no proprietary interest to risk? It seems to me that somewhere in between lies a desirable road to follow.

Granted that the Government is a buyer, and that as a buyer, it should get what it pays for and should not ask for more than it does pay for. If a contractor is asked to contribute a lot of knowhow, such as special hardening techniques or some fabricating trick or other technique which has made this contractor pre-eminent in his field, then that is a special consideration.

Clearly there can be other considerations; for example, the importance of second sources. In the interests of having second sources and of having knowledge disseminated so that it can be used in other geographical areas, it may be proper for the Government to ask the contractor to give up this kind of information. But if it is proprietary in character, if it was developed by the contractor at his own expense, if it is the kind of information which gives this contractor an edge on his competitors in civilian commodities, then it seems to me only proper that the Government should get the right to that knowledge for use on military equipment only.

If it is not practical to police a production technique, then I feel that it is only fair for the Government to pay some kind of price or arrange for some kind of royalty, so that when the contractor's proprietary rights are used by others, or are given to others, some recognition and some compensation is paid to the contractor.

Buyers' vs. Sellers' Rights

This is not a simple area of procurement. The ways the problems arise are as follows: The Government asks for something to be built, and at the end of the contract asks for information of various kinds for various purposes, such as for standardized cataloging. Now, that kind of information can frequently be given by the contractor in a way which does not tell how the equipment was produced, but merely gives a physical description, and some drawings or pictures. If the Government also asks—as it should ask—for sufficient instruction so that the equipment can be used and maintained, then more information is requested. But that kind of information also, it seems to me, is within a buyer's rights, because a buyer has no reason to buy a piece of equipment which he is not able to use.

The final type of information is data which will permit others to reproduce identical equipment. This information can go far beyond just description of this equipment. It can go so far that a manufacturer has to tell exactly *how* various gears are hardened, *how* accuracies are achieved, and so on. This kind of production technology, it seems to me, is well within the concept of technical data which constitutes proprietary property. If the contractor can make a valid case that this data is not common knowledge, the Government, if it desires the proprietary data, should make a *separate purchase* of the information. If it must be acquired by the Government, it should be taken under some provision by which it cannot be used to the contractor's disadvantage.

It seems to me that in the area of proprietary rights, recognizing both the interests of the Government and of the contractor, some middle ground is preferable. It should not be necessary either to take all the contractor's rights away or to promulgate such regulations that the most obviously qualified contractors are eliminated.

Face Up to the Real Problems

So there you have it from all four of us—four questions: (1) how should research be distributed among various organizations? (2) how can research information be made most available and useful? (3) to what extent should the Government support basic research, whether directly or indirectly sponsored? and (4) in this whole shuffle, how should the private contractor's proprietary rights be protected.

None of these questions is easily answered. The problems involved are all difficult. None of the subjects has been exhaustedly explained or discussed. There must be many questions. There are five of us up here on the platform and there are sufficient people in the audience who can help to shed some light on these matters. At least this must be said: Industry and the Armed Forces are Partners. They should be Partners in Progress. Proper answers to the questions are possible and should be given. The problems will not be solved by avoiding them. They should be faced and resolved. Procurement and defense will be better if they are.

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Forum on Research

• Questions and • Answers

Question: I would like to hear some discussion from General Cook concerning his remarks on the allowance for or the support of basic research in overhead. His remarks seem to be a little inconsistent with those of the other speakers, also somewhat inconsistent with the general encouragement of basic research in industry.

General Cook: Well, my remarks were directed to the fact that I do not feel that basic research should be supported as an overhead charge. I recognize that there are certain projects such as the development of a new aircraft, if I may switch this over to the Air Force point of view, where you will run down many channels of research, all of which are worthwhile. But I question that you should expect this to be a part of the contract. Perhaps it is necessary at some point along the line to stop on the avenue which you are going down and which looks promising, report it, if you will, to the Service with which you have a contract, and get an authorization for the contractor to pursue that particular field of research. If you try to tie this problem to small industry, I might have a little controversy with our friend from Arthur D. Little, Inc.

What would be the effect on small industry if you try to let him do this thing as an overhead cost? It seems to me that in a small industry you usually have one or two good, talented people who surround themselves with a number of craftsmen who help them to carry out these particular thoughts. How would you attempt to solve that? It is one of the things which you cannot answer.

On the other hand, it seems to me, definitely, that at this particular point you would go to this organization and you would hire a particular brain to work on the particular thing that you want done. This would not be part of the overhead of a large contractor. It would be devoted specifically to the talents which this individual has professed.

Question: I am from Arthur D. Little. We do general industrial research work and support internally a large number of projects of a basic research nature. Some of these are more related, possibly, to commerical application, but being basic, they have, we hope, a general application to a number of things. In addition, some of the agencies do have direct contracts for basic research projects. But it is this encouragement to internally sponsored research work that I am interested in —the extent of the Government's interest in supporting through overhead.

General Cook: I would like to call on the Director of Research in the Signal Corps Engineering Laboratories for his remarks on the subject—Dr. Harold Zahl. (*In the audience.*)

Dr. Zahl: I have been thinking about this subject for many, many years, and if there is one thing on which I have spent weeks and weeks and weeks of unnecessary time with hundreds and hundreds of people in the Services, it is this: *What is the difference between basic research and applied research?* That was point number one. Point number two: If there is anything that is difficult in setting up a contract with industry, it is the question of getting communications between the auditors and the accountants and the industry as to whether the work is legitimate or not legitimate. I would just dread to see a basic research overhead charge with a development or a production contract, and leave it to the auditor or a contracting officer to determine whether it is a legitimate basic research item or some development work related to some other contract.

Now, most of our large industries—the very successful ones—have always supported basic research, and it has paid off. They do it out of profit. If there is one place where the private enterprise of the United States rests most firmly, it is on the initiative of people. How are you going to hold this capitalistic nation if you do away with these initiative potentials, which means gambling on brains with industry?

Now, my final point: One of the weakest things in the entire Defense Department today is the fact that our educational system is not keeping up with the demands for our scientific people. We are not turning out enough graduates. If you turn unfettered dollars loose into your industrial system for basic research which nobody seems to follow and check on, what does that do to our graduate schools?

It means, first, that industry can pay the same amount of money for basic research that they can for private research and development. And if that isn't going to drag out more college professors from our educational system, and if that isn't going to cut our graduate schools down to shorter periods of true education and instruction, then I am going to be surprised, because I think that the weakest link next to—or perhaps even above—the question of reliability is the failure to back this industry defense picture with a really, truly, rapidly expanding educational program. And I think that if we put basic research as a legitimate charge, we are taking a step backward.

Let's pay for it where we find it—where the ability is—be it in industry, be it in the educational institutions, or be it in Government laboratories. But don't leave it as a muddled piece of money for a bunch of auditors and accountants to figure out whether it is basic, applied, or development.

A highlight of the banquet was the presentation by Maj. Gen. James D. O'Connell, USA, Army Chief Signal Officer and AFCEA vice president, of the AFCEA-ROTC awards to Northeastern University students. Winner of the Gold Medal as the outstanding senior ROTC cadet majoring in electrical engineering was Cadet Major Raynor W. Taylor. (Other AFCEA-ROTC award winners will be announced in the September-October issue.)

Question: I think a great many people in this audience have had an experience in basic research like this situation. Company A develops or sees the need for a certain military gadget. They spend their own money to develop that gadget, and certainly men have shown a desire for having industry do exactly that. So that industrial group spends its money in the hope that it is going to recover that money on the production of this gadget.

(*Continued on page* 38)

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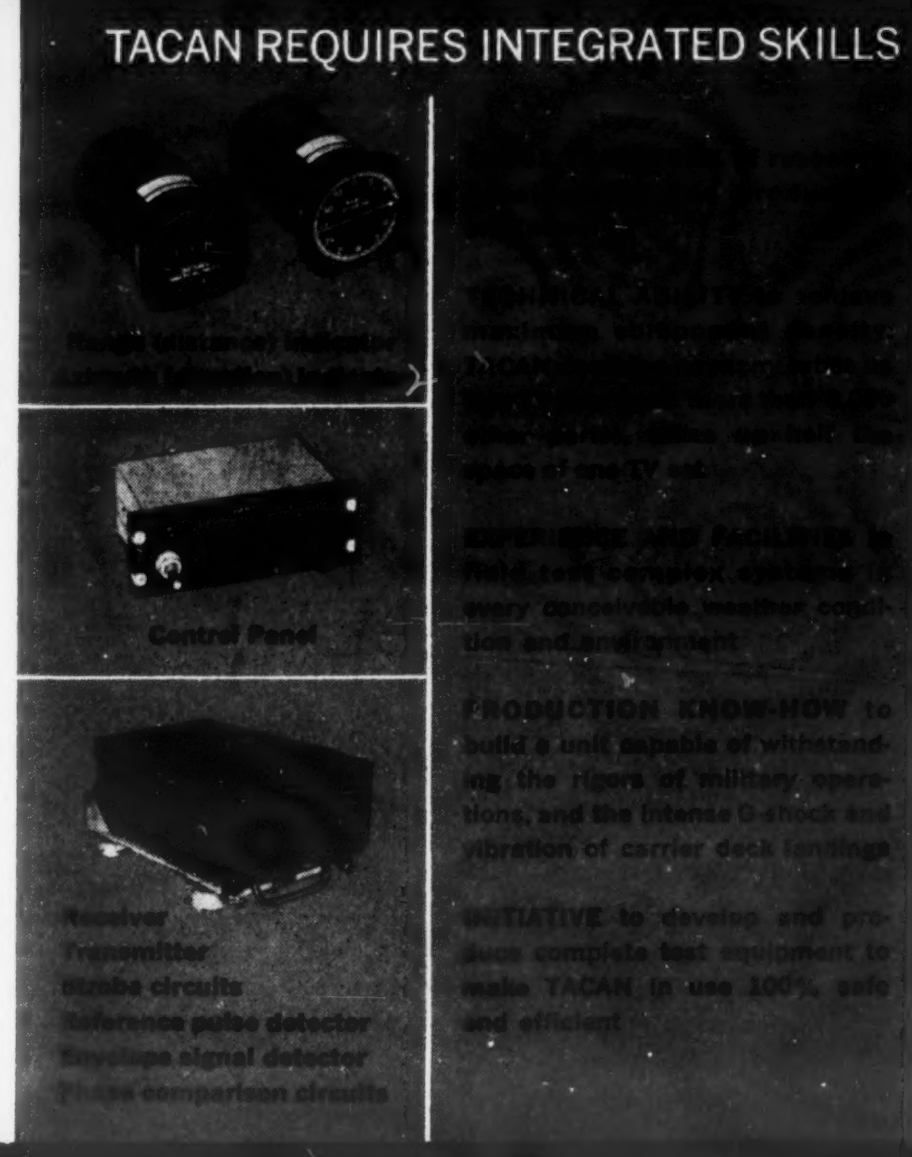
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Now, they may have to try five gadgets, or ten gadgets, before one of the gadgets is the one that is suitable for military use. If they get one out of five before they even show it to the military, that's a pretty good percentage. Now let's assume—to make this concrete—that they spend a hundred thousand dollars on the five gadgets. And twenty thousand on the one gadget that was a success. The military thinks it is fine and says, "This looks like something that we want."

There are two things that happen at this point. Either the military considers that it needs further development—and then you revert to the consideration that has been mentioned here before, where there is the know-how that has been put in by the contractor for which he is not going to be paid.

So the work from then on is work for which he will get paid, and if the gadget has gotten to a point where it is suitable for production, then the other situation applies. Specifications are drawn, the contract goes out to open bids. That is usually the case. Company B sees the specifications, meanwhile, due to the usual time that it takes between. Company C, Company D, and Company E learn about it. They see the specifications and they say, "This is something that we should be into."

All right. Who is going to bid the lowest price? Company A says, "We're on the inside track. We know how to make this." They include in their costs some of their engineering, and they try to recover these costs in production. Company B says, "Now, this is a field we want to get into. And if we lose fifty thousand dollars, it will be money that we would have spent anyway, and we will be intrenched in the field." So Company B puts in its bid. Company C is an irresponsible company. Its responsibility is under question, but the engineering group of the military doesn't have sufficient tangible data to convince the contracting agency that Company C is irresponsible, and that its engineering staff doesn't have the know-how to execute the contract. So he bids low. Then we have the series that come after that.

But the net result is that Company A doesn't get the contract. It doesn't get a chance to recover its initial expense. So what I would like to ask is this: Are the military people aware of the great extent of this situation? Is there something that can be done about it?

Mr. Bailey: General Thatcher, would you answer that question?

General Thatcher: I would like to answer that question from a couple of viewpoints. The first is that even though the military service has sometimes been accused of not being responsive to a situation, the Bureau of the Budget certainly is. It is the mission of our National Science Foundation to sponsor basic research. It is not the mission of the military services. But the military services lean over backward in sponsoring basic research by changing the name of it. That is what we do, and it is above-board. Everybody can see what we are doing. It is the mission of the National Science Foundation, however, to sponsor basic research.

Now, to answer the other part of your question, I will say that the answer is "Yes." And as to whether the military services are aware of the production ability and the contract ability of even the small firms, the answer is in the affirmative.

We have such a thing as a Source Selection Board, and it is composed not only of military people in our laboratories but also of consultants from a wide section of the country. This Source Selection Board reviews every type of contract and the capabilities of all the interested firms—it might be two hundred. Sometimes there are as many as that. I could quote one example where the firm was one of two hundred that were looked at before that one contract was left. So I would say that we do know the capabilities of industry.

The thing we do not share quite as well as we would like to share is a common knowledge and a common appreciation of exactly what the state of the art is at all times. It is a very great area, and we are always looking for the big strike and not the little, short, mincing step. Perhaps we state our requirements in a way which is not always clear to industry. And here is one area where we need a more common meeting of the minds.

Dr. Zahl: There seems to be a tremendous amount of questions as to whether the basic research is being supported and being paid for. Would the Chief of Naval Research state whether he thinks basic research is being supported by the Government, and to what extent, and whether we can do more?

Admiral Bennett: I think that question, Dr. Zahl, is slightly loaded. Basic research is being supported in the Government in several ways, as you and I both know. The National Science Foundation, as has been mentioned, and, we as taxpayers, through our elected representatives can elect and circumscribe the manner and the amount by which the National Science Foundation can operate through control over the purse-strings.

Basic research of an unsponsored nature is carried on very heavily by the Office of Naval Research, if I understand what is meant by sponsored, because our basic research program is almost one hundred per cent based on the proposals made by investigators and not by some inspired comments from the Pentagon or from Constitution Avenue.

When you come to sponsored research, the situation gets muddy, and I don't know the answer as to whether we are supporting enough or not, because you get into the area which every one calls applied research no matter how basic it may be. I hope that answers your question.

Question: I want to make a comment on the comment of the expert, Dr. Zahl. Any healthy organization is bound to do a considerable amount of basic work. Any company, like a tree, has many roots, and continuously has to keep ahead of scientific efforts. It is generally through these, you would hope, that these private companies under our system of private enterprise would exercise due diligence in the way that they spend money available to them in furthering basic research programs.

Now, this work, as has been pointed out, is conducive to military exploitation. And it is also clear that the Government should contribute to the support of it to a reasonable extent. I cannot understand the premise which says that such basic research is not chargeable to overhead expense. I am not suggesting for a moment that it be carried on a loose basis or without discrimination.

Dr. Zahl pointed out that he did not want it left to the judgment of the accounting agents of the Government as to what research should be supported. But that is exactly where it is as of today. Our present procurement regulations dictates what overhead charges are permissible, lumped with national advertising, internal education, and all sorts of things, and are approved on a lump basis. No company ever knows what percentage of its basic research was approved in overhead.

I would like to suggest that the concept of overhead charges as basic research not being permissible is incorrect, unless in this case the Army takes the steps which industry has available to it in private enterprise, namely, no

arbitrary restrictions to profit. If you take it from profit, then you must remove limitations to profits which are imposed by re-determination and renegotiation.

I would like General Cook to comment on what steps the Signal Corps is taking to remove the limitations imposed by redetermination and re-negotiation on profits.

General Cook: In re-negotiation, any money recovered does not revert to the Service. It goes back to the Treasury. Therefore, you might say that this is not a military function. It is one of the things with which we have to live.

With respect to re-determination, this problem is one that we have kicked around for some little time—in fact, ever since a letter was sent to General Gavin's office requesting that this question of overhead charge be included in the agenda. I will be perfectly frank and say that we have had as many opinions as the people with whom we have discussed this problem.

I do feel, however, that we have to be awfully careful that the monies which we put on a certain product or a certain practice give us a certain result. Don't go down some side alley a little too far. This is not unlike the problem which confronted the President some time ago when in the missile business it was necessary to appoint an individual who would rule that now was the time to stop the research and say, "Let's fly the missile."

However, to let the contractor go on when he wants to pursue a particular avenue—well, I admit that is not a very good answer, but it's the best I can do.

Mr. Holst: May I say just a word? Basic research in 1954 was eight per cent of the total research expenditures. So it isn't very large. And we have been talking—I hope—about research not assigned as yet on commercializing a particular product. We have been talking about research which was general and not the specific subject of a specific contract.

Forum on Military-Industry Relations

- ***Maj. Gen. James D. O'Connell, USA***
  Chief Signal Officer, USA
- ***Vice Adm. Edward W. Clexton, USN***
  Chief of Naval Material
- ***Maj. Gen. Thomas P. Gerrity, USAF***
  Asst. for Production Programming
  Deputy Chief of Staff/Materiel, USAF
- ***Mr. Frederick R. Lack***
  Vice President, Western Electric Co.

Maj. Gen. James D. O'Connell, USA

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Today, the three military services are faced with more and different problems than they have ever faced before. No man can foretell the form of any future attack. There is no super weapon which will guarantee victory.

The Armed Forces of the Nation must be able to win any type of war. Such wars may be long, or short, may be fought with or without atomic weapons. Certainly we must deter and prevent the holocaust. We must also deter the peripheral war—the small war—which can lead so easily to total atomic war and total catastrophe.

Let me try to put the Army's job in perspective as a basis for what you, our partners, may be called upon to supply. The Army makes each day a major contribution to deter aggression. *Since the end of World War II no fighting has broken out any place where U.S. Army troops have been stationed.* The Korean war broke out within one year after our Army had been withdrawn.

Future of C&E Growth Appalling

The Army is in a period of rapid change—change in concepts, change in weapons, change in communications. For example, we seek the means to be able to send Army forces by air to reinforce within a few days any of our forces, anywhere in the world, and thus to make available a measured force on the ground to meet the threat of military aggression on the ground.

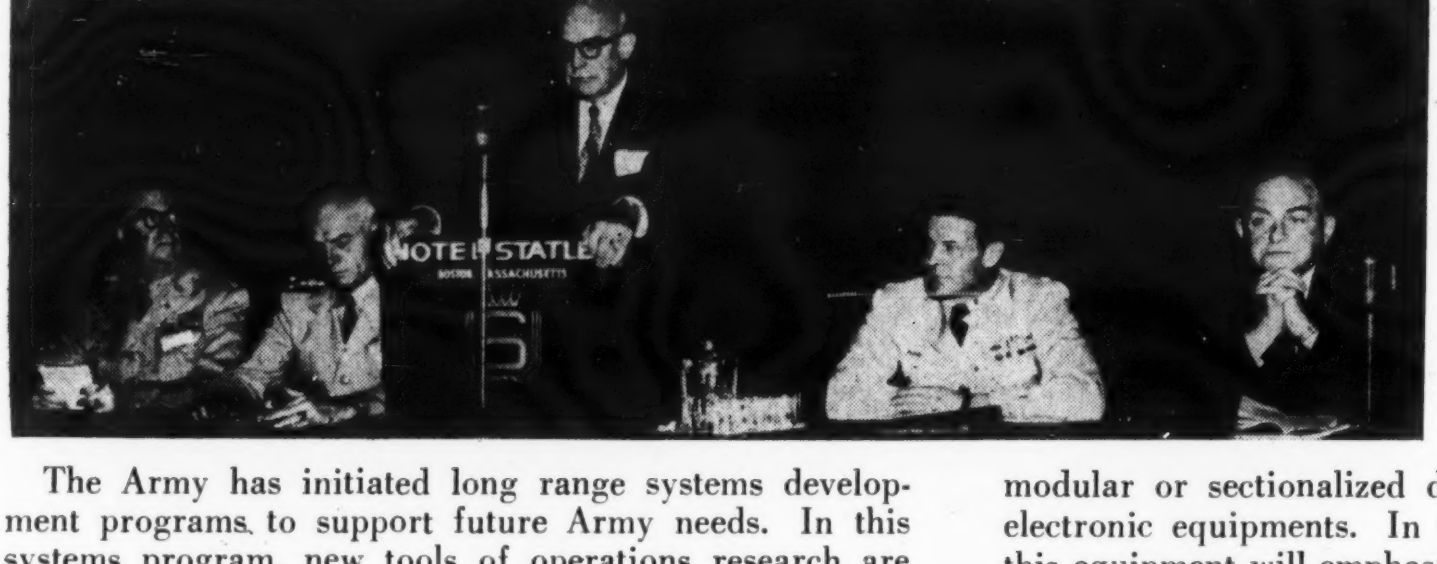
Army research and development over the past 10 years has given us a complete family of new missile weapons

(*Continued on page* 40)

which have drastically changed our firepower capabilities. The NIKE antiaircraft missile, now on guard around the clock protecting a large number of our cities, is a potent modern weapon. Our combat tactics and units are being designed and tested to fully use atomic capabilities of our Corporal and Honest John missiles which have been in service for quite some time.

To find the targets for these new weapons more quickly and to give essential combat intelligence to dispersed and mobile ground forces, we are developing and testing new reconnaissance and new battle area surveillance systems employing electronic and related devices. The rapidly growing use of thousands of Army aircraft for battlefield transport, supply, reconnaissance, and communications will depend on the electronic and communication devices in the air and on the ground for all-weather navigation and traffic control.

I think it is conservative to say that in the next 10 years the Army will experience a period of growth and development in its use of communications and electronics which will be in every way comparable to—and may exceed—the industry growth and which may further stress the capabilities of this fast moving industry.



Panel members for the Forum on Military-Industry Relations. Left to right: Maj. Gen. James D. O'Connell, USA; Vice Adm. Edward W. Clexton, USN; George W. Bailey, moderator; Maj. Gen. Thomas P. Gerrity, USAF, and Frederick R. Lack.

The Army has initiated long range systems development programs to support future Army needs. In this systems program, new tools of operations research are being employed to test concepts and practices prior to and after prototype systems and equipment are developed.

I hope you will pardon the summary treatment I am giving to the Army's forward-looking system planning but I wish to get to procurement and supply activities and an outline of our thinking in this field.

Procurement and Spare Parts

First, *procurement data.* Why isn't it always available? To do the most effective procurement and production job, adequate procurement data is certainly needed.

Just prior to World War II, the Signal Corps had procurement data for a complete line of equipment which was obsolete before it could be produced. Rapid development just before World War II produced new and advanced models but procurement data came much later.

We are still working very hard on the problem of how, in this fast moving art, to have completely modern equipment, and how to have strictly fresh procurement data at all times. We are well along with a program for conversion of our procurement data to microfilm and punched card format for rapid handling, reproduction, and distribution. This technique is called Filmsort. It will be of major assistance to our engineering and procurement staffs and to the bidders and producers of military equipment.

Next, *spare parts.* Like the weather, we have it always with us—everybody talks about it and, by and large, everybody complains about it. It is a major problem to the electronic manufacturer and a major problem in military logistics. We are doing something about it.

In conjunction with George Washington University, the Army has been carrying on a major operations research project to revise its entire spare parts philosophy. Commonly known as Project MASS, or the Modern Army Supply System, it seeks more than a 10 to 1 reduction of the spare parts now stocked in the Field Army. This is to be done by the development of a select stockage list of fast moving items to be stocked by the Field Army, plus elimination of time-consuming paperwork through use of a high speed communication-computer system and new concepts of transportation. We want to test a reduction from half a million different parts now stocked in the Field Army to about 52,000. This reduced number will actually meet 85% of the demand. The remaining 448,000 parts, accounting for the other 15 percent of demand, are to be furnished direct from the United States as required.

Instead of an order and shipping time of 120 days, we are aiming at a standard of 20 days replenishment of fast moving stocked items and 10 days delivery from the United States of items not stocked in the command.

Another major effort in the spare parts field seeks modular or sectionalized design of communication and electronic equipments. In the field, the maintenance of this equipment will emphasize testing and replacement of plug-in type components. *This will not only ease our spare parts requirements but should reduce personnel and training problems for electronic repair specialists.*

A word on the subject of our relations with industry. I cannot overemphasize the Army's interest in maintaining excellent relationships with the electronics industry. You may recall that periodically we have gone out and sampled the reactions of contractors, component manufacturers, and the trade associations as to how they view the way we are doing business with them. Sometimes the responses have been unexpected, sometimes painful, but always profitable. We intend to continue this effort.

Mr. Higgins, Assistant Secretary of the Army for Supply and Logistics, has over the past year been meeting personally with the Army's procurement and contracting personnel all over the country. This has provided the top management of the Army with first-hand information of the problems encountered at the point where industry and the Army meet on a day-to-day basis.

Data Processing Equipment for Stock Control

A word about stock management and inventory control. What is the Army doing to improve its stock management? I mention our program for exploitation of automation or Electronic Data Processing System. At

General O'Connell

Army national control points where we manage our stocks, compute our requirements and buy materiel, at depots and arsenals, and at many other agencies, computer-communication systems are being studied, acquired and installed. Electronics is offering the Army, just as it is you in business and civilian life, new capabilities in records administration, and handling of clerical and office type routines. EDPS will give us substantially improved control over supply inventories. Automation offers the Army the prospect of meeting the requirements of emergency or mobilization expansion without being plagued by the need to train and assimilate a 10 to 1 expansion of clerical workers and management. This has been by far our biggest problem in World War II and in the Korean War.

The most important effort in improving our business management is our program for developing the capabilities of our supply and logistics personnel and staff. For the past two years the Army has been conducting a Supply Management course at Fort Lee, Virginia for the senior military and civilian personnel in logistics agencies. This course is patterned after the Advanced Business Management Course at Harvard. The Harvard Graduate School of Business Administration has assisted the Army in setting up this program. So far, over 600 senior supply personnel have been graduated.

The Army has also instituted an extensive training-with-industry program for key engineering, contracting, and supply personnel. Here we have received most enthusiastic support from the communications and electronics industry. In my own organization, we have to date trained 42 senior people with representative companies in the past two years.

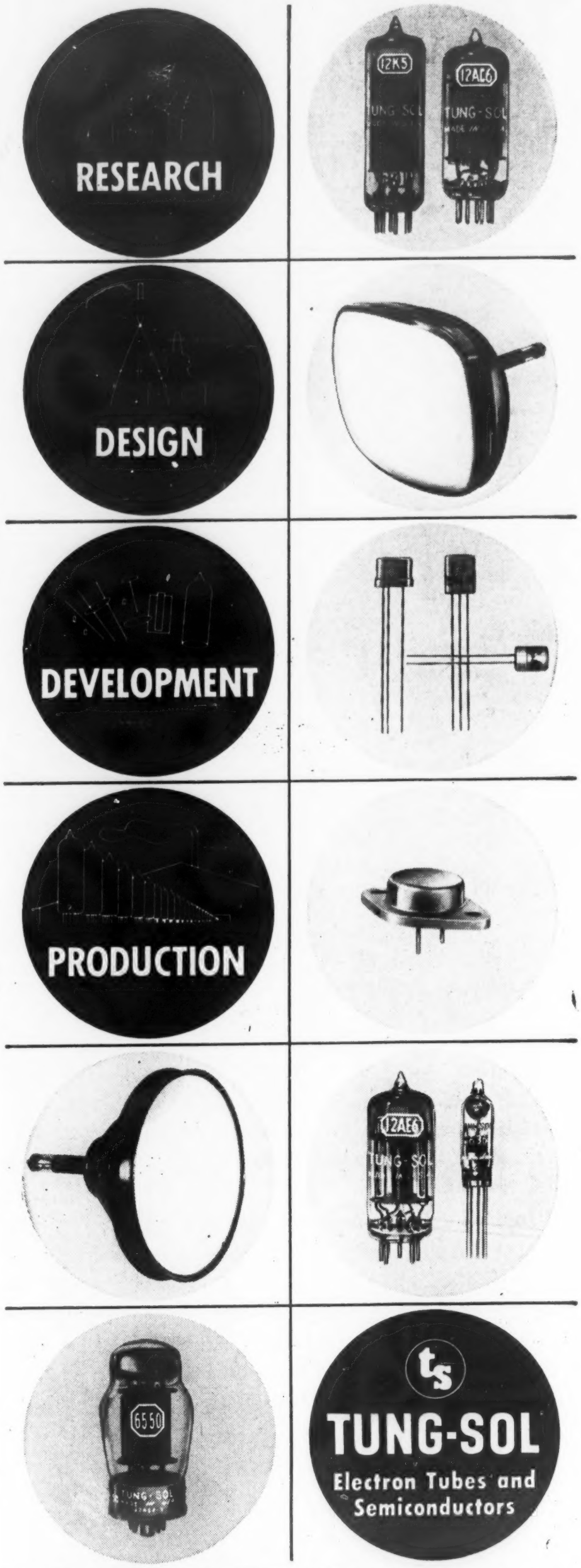
This year, as last, the Army is sending key civilian personnel to attend the National Industrial College of the Armed Forces. An outstanding Signal Corps employee from Philadelphia will represent this organization.

These are just a few of the many programs increasing the Army's fighting potential through communications and electronics and to improve its procurement efficiency and business relations with this industry. We have learned through the years on the basis of demonstrated performance that we can count on this industry in time of war and emergency for achievements far beyond the call of duty. We in the Army aspire to your equal confidence in our dedication to progress through this partnership of ours.

Vice Adm. Edward W. Clexton, USN

I AM MOST HAPPY TO BE HERE WITH YOU TODAY. IT IS always mutually beneficial to meet with industry groups in an atmosphere which encourages presentation, free discussion and hence leads to improved understanding of our day-to-day mutual problems.

(*Continued on page* 43)



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Admiral Clexton

My first topic is that of *funding long-term projects of a research nature.* For many years, research for the Department of the Navy was sponsored by the Office of Naval Research and the Bureaus from annual appropriations. However, in 1951, when the Office of Naval Research presented its budget to the Congress, it was suggested that if the money appropriated for research projects was good until expended instead of annual money which must be obligated in the current year, a much better program could be planned and administered.

The primary advantage gained from this type of financing is in the quality of personnel employed on research projects. Research scientists and their associates comprising scientific research teams are not interested in quick, short term projects. Therefore, when a contracting activity can outline a program which will be financed to a conclusion and which may require several years, the best minds can be employed. Furthermore, by this type of contracting, economies are realized in administration which permits a greater return for the number of dollars spent.

Since 1954, budgeting for all research and development has been on the same basis. The annual direct expenditure by the Navy on research and development work is approximately 500 million dollars. Of this amount, approximately 20 million dollars is allocated annually for so-called "basic research" or general research into unknown fields. Long term funding of research and development is available to the Navy and it is very beneficial.

Financing in Procurement

Now let's talk about *Contractor financing* for a few minutes. As many of you probably have learned in the negotiation of contracts, the Navy is tending toward a reduction in the amount of Governmental financing in procurement.

Immediately prior to the Korean War, Governmental financing of Navy contractors was at a minimum. The required sharp increase in production of aircraft, missiles, weapons, etc. due to Korea increased the requirements for working capital and increased Governmental financing. Placing our defense program on a long-pull basis means that the present situation should be considered "normal" and industry should be able to arrange its financial affairs in such manner as to further reduce the need for Governmental financing. Special consideration must be given to aircraft, missiles, shipbuilding and associated components, and "small business."

In order of preference, the several types of Governmental financing are: (1) progress payments; (2) guaranteed loans (with financial institutions participating to an extent appropriate to the risk involved), and (3) advance payments. The need for the two latter types of financing is diminishing and outstanding progress payments are gradually decreasing.

Our current progress payment regulations, providing for progress payments based on costs, permit payment of 75% of all costs incurred or 90% of direct labor and material costs on those supply contracts for items having a long lead time. Assuming that there is a 10% profit margin in such contracts, the contractor has an investment of about 15% of inventory and work in process.

Guaranteed loans, or V-loans, are essentially the same as loans made by private financing institutions, except that the Government guarantees, upon demand of the lender, to purchase a percentage of the loan and share in the losses. To obtain such a loan, application must be made through the contractor's financing institution, which application is in turn submitted to the Defense Department through the Federal Reserve Bank. Funds made available under such loans become a revolving line of credit. Depending upon circumstances, covenants may be placed in "V-loan agreements" such as:

(1) limitation of executive expenses; (2) limitation of dividend payments; (3) requirements for the maintenance of working capital at a specified amount; (4) limitation on backlog, and others.

A portion of the loan commitment fee and interest earnings flows to the Government, to be used to offset losses incurred through Governmental guarantee. This type of financing is being reduced. Where it is necessary, the ratio of Government guarantee should be held to a minimum.

Provisioning of Spare Parts

Advance payments are made only under the most unusual circumstances. When a contractor is in a proprietary position for the production of an item essential to our programs but is unable to obtain other financing, advance payments are authorized. Because of the infrequency of these conditions, this type of financing is not found necessary to any great degree.

Broadly speaking, the *Government should be in the financing business to the extent that private financing is not available to meet defense procurement needs.*

Another area of interest concerns *procedures for timely delivery of spare parts.* These procedures are encompassed in what we call provisioning. Provisioning is the process of determining the range and quantity of spare parts required to support and maintain an end item for an initial period of service. It involves both technical and supply considerations. Its phases include identification of items of supply; establishment of data for catalog, allowance list and technical manual preparation, and the provision for concurrent or timely delivery of spare parts with related end items of equipment.

Timely delivery of supporting spare parts, phased to equipment deliveries, is a military necessity. When an equipment goes into service, supporting spare parts must be available in sufficient quantities to insure that the equipment is kept in operation. Through the provisioning process, spare parts are selected and their manufacture or purchase is phased to related equipment production so that the equipment is supported by spare parts at a minimum cost when it is first placed in operation.

Small Business Program

Good provisioning is a welding of the technical knowledge of the contractor, the military deployment with its logistic implications, the available supply of common items, the planned life of the equipment and its operational cycle, maintenance policy, modernization plans and a large portion of good common horse sense into a planned procurement, production, and delivery program to meet the needs of the Service.

We in the Navy are continually striving to improve our provisioning procedures.

Any discussion before this group would be incomplete without covering the *Navy Small Business Pro-*

(*Continued on page 44*)

gram. Many of our electronics producers are "Small Business." The basic aims of this program are to help small manufacturers to participate in Navy procurement both directly and as sub-contractors, and, at the same time, to broaden our mobilization base by developing new qualified and dispersed sources.

There are 74 Navy small business specialists within the major purchasing activities who assist small concerns to gain placement on the bidders' lists of appropriate Navy purchasing activities, to obtain procurement information and assistance, and to compete for Navy contracts. They insure that small business firms are solicited for all proposed procurements which are considered by them to be in the small business potential.

To supplement the efforts of the Navy small business specialists, in behalf of small business, the Navy has 46 Industry Cooperation Representatives located in the offices of the Inspectors of Naval Material throughout the United States. They help small manufacturers or suppliers obtain procurement assistance and aid them in locating subcontracting opportunities with Navy prime contractors.

Statistics on Small Business Participation

Navy Contracting Officers are making a special effort to urge Navy contractors who receive individual prime contracts valued in excess of $1,000,000 to accept and promote the Defense Subcontracting Small Business Program. Since July 1, 1955, more than 104 major prime contractors have accepted this program.

In February 1956, we revised our publication "Selling to Navy Prime Contractors" and this publication now lists 500 major prime contractors and their subcontract representatives in 41 states who can be contacted in regard to subcontracting opportunities. Copies of this publication can be obtained from my office or the Government Printing Office.

For calendar year 1955, the Navy spent over $4 billion for the procurement of aircraft, jet engines, ships, ordnance and electronic equipment, and material and supplies for the maintenance and operation of the Fleet and the Naval Establishment. Of this amount, about $900 million was awarded by Navy Contracting Officers to small business firms, or to be exact 20.7% of Navy's direct purchases for this period. *This represents 77% of Navy contract dollars in the small business potential.* In addition, based on a selective survey conducted by my Office of Naval Material, it is estimated that an additional $684,178,000 was channelled to small business through subcontracts placed by Navy prime contractors.

In regard to the Navy's procurement of electronic equipment, approximately 17.2% of our procurement dollars for the purchase of electronic equipment and communication equipment were awarded to small business firms. This is 3.5% less than the total percentage which I have cited previously and indicates an area of potential improvement worthy of our further effort.

The Navy receives excellent cooperation from the Small Business Administration and its representatives with whom our Navy Small Business Program is carried on as a joint program. Through Small Business Administration representatives assigned to Navy purchasing activities, small business firms receive assistance in regard to the issue of certificates of competency covering financial and technical ability to perform a contract, small business loans, and the reservation of selected procurements ("set-asides") for exclusive small business competition.

The Small Business Program enables us, through widespread competition, to lower our procurement costs. It preserves critical labor skills and trades in dispersed areas, and enables the small businessman to participate in his Nation's defense program.

Necessary Planning for Mobilization

Next let us talk about the *mobilization base and allocation of programmed equipments.* Let me define the mobilization base. The mobilization base is the total of all war-making and supporting resources available at any current point in time including: (1) the Armed Forces in being, both Active and Reserve, and elements affecting their state of readiness (manning levels, state of training, modernization of equipment, mobilization material reserves, and facilities), and (2) the supporting resources of the Nation, including, for the purpose of our discussion, manpower, industry, materials and technology, and the elements affecting the state of readiness of these, such as planning with industry for rapid expansibility, convertibility, and dispersion. An evaluation of the state of readiness is made periodically by all interested parties when the annual budget is submitted to Congress. A reasonable readiness position is planned for the foreseeable future in the Armed Forces, their modernity and their Reserves. As part of this process, a detailed study is made of thousands of the most important items and funding is provided.

In addition to the current production, we must look to our wartime production plans to insure an orderly shift to mass production of weapons. The Production Allocation Program is the link and provides direct planning between military buyers and wartime manufacturers of specific items.

Weapons Systems Responsibility

Finally I am going to talk about two subjects which are listed separately on your agenda, but which I prefer to consider simultaneously. These are the *"Weapons System Concept"* and *"Contractor versus Military Systems Responsibility."*

Much has been said and written about the weapons system concept. It would probably be well to include here a definition; however, what this term means is somewhat a matter of personal opinion, particularly with regard to degree of application. A Naval weapons system encompasses the weapon or weapons and the equipment employed to bring the destructive power of the weapon against the enemy. The system, for proper application, requires detection, location, identification of a target, delivery and control of the destructive units. To some, this means, for example, that when buying an air-to-air rocket you contract with a prime contractor for a complete round, packaged and ready to fire. To another, the weapons system is a complete aircraft including the airframe, power plant, guidance system and the armament for which it was designed or perhaps which was designed for it. By the process of all inclusion, the weapons system might be expanded to include the aircraft carrier, its air groups and their armament, the ship's protective and attack armament components, and even its personnel and material logistics.

(*Continued on page 46*)

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Admiral Clexton

For our purposes, the second example is more appropriate to application in the contracting field. The rocket round is a destructive unit, but not a "system," while the carrier with its planes is obviously too complex a combination of systems to be contracted for as a package.

I believe that you are more interested in this term insofar as it describes a trend and in the effect of that trend on you as suppliers of electronics and communications equipment.

I believe the tendency is to move toward a system where the contractor is given more responsibility in the program. No rapid changeover will occur—just a steady reduction in Government-furnished material. If the advantages claimed for the system are forthcoming, the changeover will be accelerated. As an example, the Navy contracted for the A4D, a carrier attack bomber, with the El Segundo Division of the Douglas Aircraft Corporation on what was close to a package deal. The success of this venture will tend to shape the future in aircraft procurement.

There will continue to be a need for close association between manufacturers and our operators to insure success of our weapons. Such meetings as this, daily contacts of interested parties, your technical representatives in our units, and patience are needed in this rapidly changing period.

Today, the Navy is changing from steam to nuclear power, from rifled guns to guided missiles and from subsonic to super-sonic airplanes—all at the same time. Never before in history have such revolutionary changes taken place. We need your help. We are depending on you.

Maj. Gen. Thomas P. Gerrity, USAF

IT ALWAYS GIVES ME GREAT PLEASURE TO BE A participant in furthering the close relationship and understanding that must be achieved between the Armed Forces and industry in this era of vast technological advances.

As you are well aware, tremendous advances have been made during the past decade in weapons systems utilized by the Air Force for the performance of our mission, and of particular interest today is the increasing use of electronic equipment in our weapons. The use, which has unquestionably increased our capability in an era of supersonic speeds, has grown steadily over the past few years.

In FY 1952, approximately $883.3 million out of $9.2 billion, or 9.6%, of procurement dollars, was programmed for the procurement of communications and electronic equipment. Comparing this with the current fiscal year availability of $1.4 billion out of $8.4 billion, or 17.3%, of procurement dollars, emphasizes the growth that has taken place in Air Force usage of electronic equipment. While it is anticipated that our over-all procurement will be maintained at approximately the current level during the next few years, we foresee continued growth in the electronics area.

Inherent in any growth of this nature are many problems which industry and the Air Force must solve if we are to increase our utilization of electronic equipment. The major problems presently being encountered are: lack of adequate specifications caused by late development; failure to meet production schedules, and, most important of all, failure to achieve satisfactory reliability.

Delays in Development Programs

Development-production programs in electronic equipment have been undertaken to meet our increasing needs. However, development time tables have not always been met. For example, of the amount programmed for FY 1955, only 72% was obligated as of 31 March, 1956, 9 months after the end of the fiscal year, principally because of the delays in development. The impact of these engineering and development difficulties is also reflected in our production record for calendar year 1955 during which deliveries of major electronic equipments were only 80% of the dollar value of scheduled production.

These delays have disrupted our progress in achieving a balanced capability in our air and ground environment. In addition, as a result of these delays, we have not been able to carry out planned procurement programs. Therefore, our current programs are being discounted until we have demonstrated a capability of meeting desired production goals.

Another problem is reliability. During my tenure of duty as a tactical commander from 1950 to 1953, the vast majority of mission aborts were caused by failures of the electronic gear incorporated in the various systems such as bombing-navigation, fire control and communications. The other most critical item was the power plant.

In the case of the power plant, the evolution of the jet engine has given us greater speeds, more reliability, and reduced maintenance workload over that previously required for the reciprocating engine. Conversely, electronic equipments have increased the maintenance workload tremendously by virtue of our failure to achieve the necessary reliability.

This problem is further aggravated by the large turnover of military personnel who maintain our electronic equipment. It is currently estimated that 42% of our skilled electronic personnel will leave military service during the next two years as the Air Force has not been able to compete with the salaries and benefits offered by industry.

I can add little to the volumes that have been written, nor can I offer any magic solution to this momentous problem of achieving reliability. However, a real challenge faces the Air Force and the communications and electronics industry to increase reliability of equipments and reduce maintenance requirements.

Air Force Supervision of Contracts

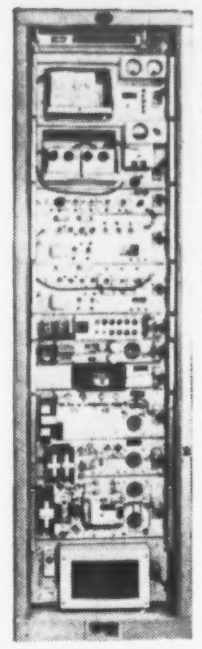
Turning now to the subject of Air Force-industry business relationships, it has not been nor is it the intent of the Air Force to assume system responsibility that has been vested in the prime contractor. This responsibility is basically industry's. However, we have certain policies

(*Continued on page* 48)

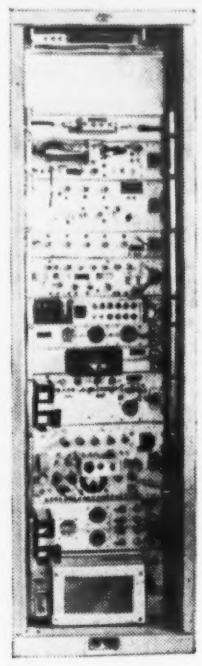
Sea sentinels

A key factor in the nation's defense is the Air Force's oceanic chain of Texas Towers now under construction. For communicating their findings, these radar stations—like those in the continental North—rely upon the forward propagation tropospheric scatter systems developed by REL.

In this case, REL has supplied the transmitter exciters and diversity receivers which make possible long range tower-to-shore and shore-to-tower communication without booster stations. Performance and dependability quite naturally exhibit REL's world-famed standard of excellence.



Type 798T transmitter exciter



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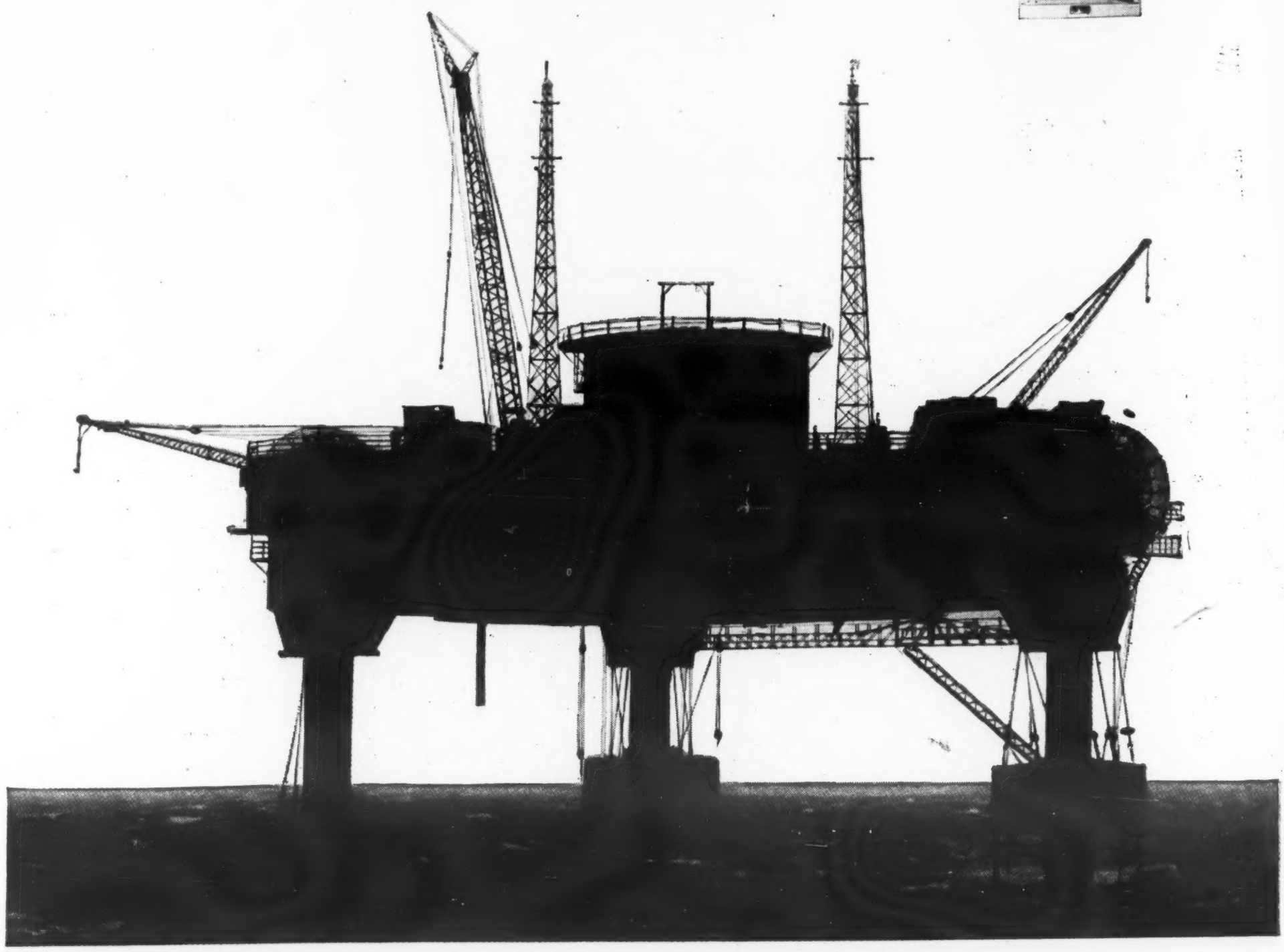

which must be carried out in our procurement programs if we are to achieve and maintain a modern Air Force in-being that will insure our operational readiness for any emergency. . . .

I know you will agree that the maintenance of a broad production base to provide for rapid expansion in the event of mobilization is absolutely essential. This requires that the Air Force take into consideration such factors as *maintaining multiple sources of supply, preserving essential skilled labor forces, and encouraging maximum subcontracting.*

In carrying out this policy, the Air Force requires proposals covering critical items (preferential planning list), outlining the proposed subcontract structure, and anticipated percentage of subcontracting effort. We recognize, however, the tentative nature of a proposed subcontract structure at the time of negotiating a contract, and we are also fully aware that our prime contractors must continually review their subcontract structures in light of performance, delivery schedules, and costs. A given prime contractor's planned use of a particular subcontractor may be significantly affected by plans of other prime contractors to utilize the same subcontractor. Air Force knowledge of the plans of other prime contractors can effectively avoid the inadvertent overloading of a subcontractor because of the inability of coordination among prime contractors. In no sense is a prime contractor's responsibility in this area diluted by Air Force procurement inspections or contractual provisions, since changes in subcontract structure require only prior notification and not prior approval.

Types of Emergencies Differ

The factors of multiple sources and broad subcontracting, I have just mentioned, partially assist in providing the essential ingredients from which we can accelerate production when needed to meet a particular threat. However, our production requirements may well differ for each basic type of emergency.

For example, in a "localized" or limited conflict, we need rapid acceleration of tactical and support equipment, but we can assume we have not suffered serious industrial damage. On the other hand, for the "all-out" war, we need all the offensive and defensive equipment we can get in the initial critical phase (first few weeks) and we must consider we may have suffered serious industrial damage. And, for the "cold war," we need the capability or potential for rapid expansion, either selectively or across the board.

In the limited or localized war situation, we wish to have a production acceleration capability for selected tactical and support equipment. In this case, we establish a reserve production capacity for selected items which is backed up by advanced purchase of semi-fabricated materials, such as forgings, plate, bars and extrusions. This increased inventory in prime and subcontractor plants will cover the early part of the acceleration until the necessary increased flow of materials from suppliers is effected. This type of planning generally results in reaching peak production rates 6 to 8 months earlier than was previously possible.

For the "all-out" war, we have developed a production compression concept which provides for maximum deliveries in the first 30 to 60 days. Producers will be required to extend the work week on an all-out effort basis and to deliver to the Air Force every possible aircraft in the initial time period. It involves, among other things, a balancing and increasing of the inventory of certain limited items through current purchases of such items. The total inventory in each case will, of course, be consumed as the last quantity of aircraft are produced. Through this compression plan (on strategic and air defense weapons) we believe we can get twice as many aircraft as would normally be delivered in the initial 60 day period.

For the cold war situation, we are retaining reserve machinery and related production capacity in active producers' plants. In this case, major emphasis is being placed on an "in-being" capacity that can rapidly accelerate or compress production as future world air power dictates, rather than relying on inactive or lay-away capacity at remote locations.

Allocations to Small Business

Essential to the maintenance of the broad production base is the participation of small business concerns. In this regard, the Air Force has had a long standing policy that a fair proportion of total purchases and contracts will be placed with small business concerns whether as prime contractors, subcontractors, or suppliers.

About 90% dollarwise of the contracts placed directly by the Air Force is beyond the scope of small business to supply as prime contractors. Realizing that small business was not receiving a fair proportion of the remaining 10% of Air Force dollars, we instituted an aggressive program in 1951 designed to increase small business participation. I am glad to report that small business concerns are now receiving about 75% dollarwise of all contracts for supplies and services that are within their capabilities to produce or perform.

In addition, we have held a series of meetings across the country designed to encourage the large prime contractors and their major subcontractors to place a maximum amount of subcontract business with small business concerns. The response we have had is most gratifying as reports being received indicate that approximately 25% ($2 billion) of Air Force procurement dollars is now going to small business.

We believe that our program is sound and is providing small business with an equitable opportunity to compete for Air Force business.

Specialized Industries Maintained

As previously stated, considerable advances have been made during the past decade in our weapons systems. Our equipments have become increasingly complex and the environment in which they must function has necessiated closer coordination between the air frame manufacturers, associated equipment manufacturers, and the Air Force to insure that our tactical units receive a fully integrated system, completely capable of accomplishing the mission for which it was procured.

To accomplish this objective, the weapons system concept was evolved by the Air Force as a management tool with the prime contractor being held responsible to insure that the total weapons system meets its performance specifications.

The selection of the prime contractor as the focal point of management does not mean that he is licensed to develop and produce equipments normally accomplished by the specialized industry. If such were the case, the

General Gerrity

Air Force would rapidly lose the broad production base and we will not condone such action.

The weapons system concept is a team effort with the prime contractor, the associated contractors, and the Air Force working together to obtain the desired result. Our experience to date with aircraft, missiles, and ground environmental systems such as "DEW" and "SAGE," has proven this concept to be sound and, we believe, rather well understood. The weapons system concept and other Air Force policies emphasize the added responsibility that we are placing in the hands of industry.

Another example that I might cite is our spare parts provisioning. The Air Force includes, in its basic contract, information relative to the planned utilization, such as programmed flying or operating hours, mobilization prepositioning or "kit" requirements. The contractor is given the responsibility to select the spares and release them for production without prior approval of the Air Force. The costs of cancellation resulting from subsequent non-approval by the Air Force of the contractor's actions by the provisioning team are borne by the Government. Our experience to date shows that the costs of cancellation have been insignificant, whereas this authority has contributed appreciably to the attainment of adequate and concurrent support.

I think this procedure demonstrates our feeling that industry has, or must be expected, to develop a capability to properly analyze the range of spares required.

As I see it, the electronics industry faces some very important challenges today. These are: (1) much greater gains must be made in simplicity and reliability of electronic systems; (2) we must achieve a closer adherence to our development-production schedules—the 80% delivery figure I mentioned earlier for electronic items in calendar year 1955 must be improved if we are to develop and maintain a modern force, and (3) the increasing management responsibility placed on industry requires that Air Force-industry relations reach a new high in mutual understanding and team work. Only through a maximizing of our joint efforts can we reach the goals vital to our national interests.

Our increasing reliance on electronics in the future will be greatly influenced by the ability of industry to meet these challenges.

Mr. Frederick R. Lack

WEBSTER DEFINES "TEAM" AS A GROUP OF PEOPLE pulling together. This meeting here today is typical of the pulling together of military and industry working in the fields of communications, electronics and photography. I should like to compliment the members of the three Services who serve on our Board of Directors, who give freely of their time, energy and ideas in promoting this team concept.

There is, however, one phase of Government-industry relations where the team definition appears to be lost sight of. This is in the area of military procurement.

As the largest customer of American industry, the Government has tremendous power and natural bargaining position which is buttressed by restrictive, permissive or mandatory legislation of the Congress, supplemented by extensive regulations under such legislation. This power can be used with restraint and with an intent to strengthen industry generally as a base for long-term prosperity for all the people and as a mobilization potential in time of war. Or it can be misapplied and tend to drive industry away from seeking or accepting Government orders if adequate commercial business is available elsewhere.

Thus, the Government's procurement policies should strike a careful balance between using this tremendous power to insure the maximum legitimate protection to the taxpayers on the one hand, and to induce the widest possible participation in Government business on the other, especially during the time of peace and widespread domestic prosperity when there are other matters demanding industry's attention.

AFCEA student members of the Northeastern University Chapter set up a "ham" radio station (KIWAS/AAIWAS-MARS) in the room provided for this student chapter at the Hotel Statler. See Chapter News, page 78, for a complete report of the Northeastern University Chapter activities during the Convention.

American industry has learned over the years that purchasing, to be successful, must be done in an atmosphere of mutual respect. Lines of responsibility between supplier and customer must be clearly drawn and there must be real concern on the part of the customer for the continued successful operation of the supplier.

It is my thesis this afternoon that in recent years little or nothing has been done to make participation in Government business attractive. On the contrary, doing Government business differs so widely from the customer-supplier relationship described above, and it is surrounded by so many restrictions and red tape that many companies with other commercial business stay in Government business for patriotic reasons only.

This is a serious situation. To win the cold war without wrecking our economy requires the wholehearted cooperation of all concerned. Anything less than this jeopardizes our future.

During the study of procurement by the last Hoover Commission, a representative industry group was asked the following question. Since the Government is industry's largest customer, do you feel that it is practical to establish a customer-supplier relationship more nearly like that in industry? Or, due to its size, special nature

(*Continued on page* 50)

of its procurement, use of public funds or its political aspects, is such a relationship impractical? A large majority of the replies indicated that it was practical. Moreover, the same questionnaire sent to contracting officers elicited the same answer.

These replies represent the opinions of many people who have looked at this procurement situation in detail. These people recognize how much in time, effort, and money the present contracting procedures cost.

Why Relationship Has Broken Down

The relationship between the Government and its contractors has departed from the customer-supplier relationship in industry for the following reasons:

1. Special restrictions imposed by hundreds of statutes.
2. Thousands of regulations, directives, bulletins, and manuals promulgated by executive bureaus.
3. Devotion to procurement procedures rather than policies, including the failure to invest contracting officers with authority and discretion commensurate with their responsibilities.
4. Distrust and suspicion of industry, with the predisposition to class all contractors on the level of the worst scoundrels with whom the Government may have done business.
5. Attempted exercise of managerial control by the Government over its contractors.

My remarks today are not directed at contracting officers. *It is my belief that they are the most conscientious, overworked, and underpaid group with whom I have ever done business.* My quarrel is with the people who set up procedures instead of policies. The people who write the "thou shalt not" directives. The demagogues who want to use military procurement for political and social objectives.

In the administration of the Government's procurement policies, delegation of authority is established by very precisely drawn regulations and directives. As a result, practically all levels of administration must operate within very circumscribed limits, and any deviation from those limits by the contracting officer or request on the part of contractors for an exception to a particular contract clause or regulation requires higher level approval.

Decentralization a Problem

It is interesting to note that at a time when industry is busy decentralizing, the Department of Defense is going the other way. What used to be delegated to regional offices now goes to headquarters, even up to the Department of Defense level itself, and recently the Bureau of the Budget appears to be getting into the act.

It is no wonder then that the contracting officer, who is trying desperately to meet the scheduled needs of the Service he represents while funds are still available, becomes frustrated by the delays he encounters in finalizing a contract.

If you go back to the reasons why some of these laws, regulations and delegations were promulgated, you would find that through some error in judgment or some slip in the machinery something was done that made headlines. Usually, the incident was magnified to the public much beyond its importance, but to prevent the recurrence, regulations or laws were revised or directives issued. Because the people who rewrote these documents, although well intentioned, had no practical experience on the contracting firing line, they could have no appreciation of how much the new rules would hamper the contracting officer and his contractors in the efficient administration of contracts, the production of goods, and the cost thereof. As a result, these executive and legislative actions are in the process of burning the house down to get rid of a few ants.

Take the matter of profits on Government business as a typical example. Congress and the Pentagon have placed specific limitations on profits of cost-plus-fixed-fee and negotiated contracts and have set up a Renegotiation Board to catch anything that slips by these limitations. They have also brought tremendous pressure to bear on contracting officers and negotiators to wring the last penny they can out of the contractor's profits. No one will condone exorbitant profits on Government procurement but "exorbitant" cannot be defined in absolute terms as a percentage on sales. What might be an exorbitant level of profits on one contract might be reasonable on another. Industry has learned that it is a good buying policy to reward the efficient low-cost producer who delivers quality merchandise on schedule.

The financial strength of any individual company or of an industry cannot be measured by the amount of sale, the extent of working capital, or the total floor space of its plants. *It depends upon profitable operation.* A profitable organization will attract capital and credit. It will be able to employ and retain the most capable engineers and craftsmen. A concern which consistently loses money will deteriorate. Its financial position will weaken and the quality of its products will suffer as its best employees drift away in search of better opportunities.

The Government cannot guarantee profits. On the other hand, it can and should create an atmosphere as conducive as possible to profitable industry operations. The present trend seems to be directly opposed to such a concept.

Lest you think that my sole complaint is the low rate of profit allowed on Government business, I should like to emphasize that this is only one facet of the problem. There are many other examples I could cite, such as the Walsh-Healey Act, which requires special pay treatment for workers on Government contracts; the Government's attitude on patents and copyrights, with its detailed reporting procedures; the controls on subcontracting and Government facilities; the regulations on allowance costs, all of which require frequent audits and a tremendous amount of paper work. To go through a typical contract, with all of its clauses, would require much more time than I have here. Anyone familiar with the Armed Services Procurement Regulation could cite examples *ad infinitum*.

Four Suggestions for Improvements

What then can be done about all this? It is my recommendation that a better relationship can be created to the lasting benefit of both the Government and its contractors if the changes and improvements outlined below can be adopted:

1. **The Government should abandon efforts to exercise more and more control over its contractors and to interfere with their methods of doing business.**
   a. **Reestablish profitable industry operations as a criterion for successful procurement.**
   b. **Let the contractor select his own subcontractors, and eliminate Government dictation of the**

Mr. Lack

terms upon which business shall be subcontracted; whether such dictation be cloaked in the guise of price approvals, distressed labor areas, patent policy, or political considerations.
tions.

c. The powers vested in procurement officials under the headings of renegotiation, redetermination, audit, etc., offer a handy method of exercising management of financial controls. Let the exercise of such powers end with the accomplishment of the functions for which they were designed.

2. The Government should delegate authority to contracting officers consistent with the responsibilities assigned to them.
   a. Reduce the number of clearances required within an agency or bureau in order to place a contract. This should include a reexamination of the part played in some agencies by review authorities who exercise plenary authority over procurement terms without ever meeting the contractor's representative or understanding his problem.
   b. Let the contracting officer exercise his judgment and experience within the framework of basic policies. Organize Government procurement offices more in line with the purchasing departments of private business.
   c. Improve the caliber and efficiency of personnel engaged in Government procurement. The rotation system used for officer personnel may be unexcelled as a military training device, but it is an invention of the Devil as a procurement practice. Below the officer level there should be employees of high caliber. Higher salaries should be paid, if necessary, to attract them.
3. Reevaluate and revise the entire structure of procurement regulations, directives, bulletins, manuals, etc., to accomplish the following objectives:
   a The elimination of duplications, conflicts and suffocating details which serve only to stultify the judgment and initiative of contracting officers and erode the efficiency, ingenuity and incentive of contractors.
   b. Provide standards and guides consistent with the true function of procurement, but omit all matter irrelevant to that function.
   c. Extend the practice of consulting with industry concerning additions and revisions to procurement policies.
4. Abandon the policy of requiring uniformity in the treatment of all contractors (not to be confused with equality of opportunity). The Government should recognize integrity and reward merit—just as private business does. Superior performance should be given tangible recognition in the form of higher profit allowances or preference in placing contracts.

Now the question is what can be done about this? Two Hoover Commissions and many committees set up by the military and the Congress have recommended action along the lines I have indicated. In fact, I have lifted some of the above language from their reports.

There have been no tangible results thus far. On the contrary, the situation is getting worse. The present system is complex and deeply entrenched. It is thoroughly understood only by the specialist. Hence, any attempt at reform tends to get bogged down in wrangling over particular details.

A Real Challenge to be Met

But here's a challenge—a chance for real teamwork. If, through this Association or other similiar groups, we could publicize to the managers of this enterprise, the Congress, the Department of Defense, industry leaders, how much this cumbersome system is endangering the whole plan of defense, if we could publicize how much it is costing the country in money and manpower, then, I think, we could get a real program of house cleaning on the rails. It is long overdue.

Forum on Military-Industry Relations

• Questions and Answers

Question: I would like to raise the question of the increasing use of the publicly advertised bid in the procurement of complex military equipment, which seems to be taking the place of the previously negotiated contract where, in our experience, much better arrangements were arrived at both to the Government and industry satisfaction as far as price was concerned and in the elimination of any conflict in the specifications.

General Gerrity: I believe that members of this group are aware of the hearings that we had before the House Armed Services Committee last January, where we had quite a lengthy discussion on the advertised or negotiated contract awards. At that time, it was brought out strongly that it is the desire of the Congress to use advertised competitive bidding wherever possible in procurement. We advised them at that time that we were doing just that thing wherever we could, but that most of our complex equipment—which accounted for by far the largest part of our business—was in the field where advertised bidding was impractical.

(*Continued on page* 52)

And I believe that while there are some cases where judgment might be exercised toward an advertised bid where it might just as well be negotiated, by and large we are still negotiating those that should be in the negotiated field. But as far as possible we are using the competitive procedure. About 90 per cent of our business, or higher, is in the field of negotiated bidding. Less than 10 per cent is in advertised bidding. We are trying to use the best judgment that we know how. I am sure that I am speaking for the Army as well as for the Navy. To restrict to the advertised field those items that are feasible to advertise—again we get into that very difficult judgment area where in some cases we might start out advertising and have to go to negotiating when we can't reach a satisfactory conclusion. I am not sure that answers your question. But we are trying to follow the line, and, at the same time, carry out the will of the Congress.

Question: I would appreciate very much a comment on that by General O'Connell.

General O'Connell: Our proposition is very much the same. We recognize this as an area in which judgment is involved—and patience. The basic policy under which we operate is that advertising is the preferred method. However, we recognize that with complex equipment in which modifications are being introduced, cases in which the procurement data is not adequate, and also in the area where adequate competition among plant producers can be obtained through negotiated contracts, that these areas need negotiation. And our percentage—I don't have it at the tip of my tongue right now, but it is comparable to that of the other two Services. Maybe it runs a little bit lower.

Question: I don't believe that you can go down to the corner drug store and buy a B-52 bomber. I certainly understand that such a device has to be negotiated. By and large a number of people here are representing a small industry. In small industries we do not qualify for B-52 bombers, but we are nevertheless manufacturers of complex devices which we develop out of our own capital. These are sold on the commercial market. They have been accepted by the military. We find ourselves now in a position where, having done all the development work, our specifications are given out for general competitive bidding. But we have done the development work. I think that this to an extent is known to Congressmen, and the question is how to improve the procedure.

Mr. Lack: This is really something for the military to answer—but my guess is that if you have done the development work, this is a proprietary item; that under the terms of the present procurement regulations you can refuse to give the military all the information that would be needed for somebody else to make the thing, provided you can convince them that you did the development with your own money.

Then if they want a second source, I think again that experience will show that the way to do that job would be to ask you to set up the second source with a sub-contractor of yours until you got him going. But certainly at the outset if you did all this work with your money and convinced the contracting officer, I think they would withhold that information as a proprietary right. Isn't that true, General?

General Gerrity: That can be done. I would also like to say that in regard to items for which we have paid the development costs—the Government—it is our normal practice on the first production returns to give the developer the preference where reasonable conditions exist.

I'd like to add a further comment on the complexity of regulations, which Mr. Lack devoted some attention to, and so have the gentlemen from the audience. As in most of these complicated problems, this is not a one-way street. It's two-way street. As a matter of fact, in this particular case there are many streets that lead to the focal point from all segments of industry as well as Government. In Government we are charged with carrying out the will and the policy of the Congress. We find it necessary to establish some standardization of procurement practice between the Services and between the branches of the Government. This isn't an easy job, since many of our missions aren't exactly the same, although similar.

We have worked for many years in developing the Armed Services procurement regulations based on the public law on procurement. And by and large I would like to defend that myself as a good document within the policies laid down by the Congress. Contributing to that document, as well as other documents used by the Services to implement the Armed Forces regulations, are many, many comments from industry. And I think that many of the industry representatives themselves have somewhat contributed to the complications of our implementing instructions as well as the Armed Servcies procurement regulations.

We in the Government and in the Air Force are anxious to get together with industry if we can find means of simplifying and making more clear these guiding policies as contained in the instructions. You will find General Baker at Wright Field and all our people in Washington anxious to sit down with you at any time.

We do sit down with various industry associations many times throughout the year, talking over mutual problems to clarify our own instructions and to make them both equitable to the Government and to industry. And I would suggest to this Association that this is one constructive step which you can take where you feel that we have procurement instructions prejudicial to your interests and not carrying out the intent of the Government policies. Come in and sit down and talk with us. I am willing to talk with you. I know that General Baker who heads up procurement of Air Materiel at Wright Field, is anxious to talk with any industry association that has an interest in this problem.

Question: My question relates to the matter of schedules. The Chief of the Air Force recently announced that of three hundred projects of the Air Force chosen at random, only one met its schedule and performance. Now, if we accept what you said—that many of these regulations and red tape are not to the best interests of the Government and industry—can you suggest anything of a positive nature to protect the Government's interest and see that this type of performance is not continued?

Mr. Lack: Well, in some respects—and I may get into an argument with the General here—in some respects I think that the procedures and the red tape tend to delay the schedules, because it is difficult to get the finalizing of the contract. As you know, if you write a lot of words into a contract that are not readily understandable, then the man who signs the contract has to hire an expert to tell him what to do, and the expert has some ideas, and, as I said, when you get these specialists together they get to wrangling over details.

(*Continued on page* 54)

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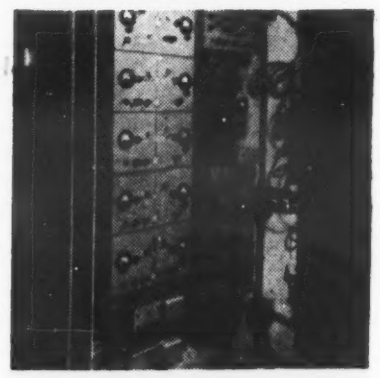

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Take the patent clauses. As I said, it started out with a single paragraph. Then some patent lawyer in the Government added another sentence. Then another patent lawyer—probably in our shop — said, "Well, that isn't clear. We've got to define what we mean." And he added another sentence. And it gradually grew, until I imagine there are patent people making it longer. But that's one aspect of these complicated regulations. You have to have experts to understand them. And when you get those experts, they want to change the language. That happens on both sides. We just can't do business on a simple basis any more.

Now, as to protecting the Government on schedules and deliveries on the completion of the development work, there is an attitude on the part of industry which I find very reprehensible. And that is, that in order to get the job, they bid, or they make their proposals show, a delivery schedule that just isn't realistic. They think that if they bid one year, and the next guy bids a year and a half, they will get the business. And once they get their foot in the door, and the Government has spent the money with them, obviously they can't cancel the contract. It's too late to do anything about it. So in that respect industry has got to clean its own house. It's no fault of the Government. Of course, if the contracting officer in his judgment knew the contractor and knew that there was this factor of optimism in one business against another, he might be able to make a determination. It's putting an awful lot of responsibility on the contracting officer. It's just as much as the industry's.

Now, here's another question about reliability. Dr. Noble, who is sitting here in the audience, wrote a very interesting paper once about how much money and time it takes to produce simple and reliable equipment. Anybody can throw complicated and unreliable gear together in a hurry. It takes a lot more time and a lot more effort to come up with a simple and inexpensive product—to produce reliable gear.

That's another bad thing about trying to get the stuff too soon—trying to put all the emphasis on time. I know that the military usually needs something *today!* But let's clean house in our own situation. Then we will have less of these fall-downs. Put yourself in the place of the military man who has scheduled a number of planes to come off the end of the line and he has scheduled the electronic equipment to fly it. It can't fly, it can't perform its mission without this gear. The plane comes through, but the gear is about a year or two years late. There are a lot of planes on the apron and a lot of money invested. He can't train his people. The whole program goes to pot just because, perhaps, somebody made a bum estimate on when he is going to produce the stuff.

General Gerrity: Just one further comment on meeting development schedules. Of course, I mentioned that example earlier in my discussion where we were about five years or six years late on one development schedule for a particular equipment. We have scratched our heads long and hard on this particular problem, and we don't know all the answers to it by any means. But recently we have gone into an incentive type of development contract with one contractor where he will get paid profit on the basis of how close he comes to meeting performance specifications and how close he comes to meeting delivery schedules and costs. And if he misses them by very far, why, his penalty will be quite heavy. Now, this is a step and it's a somewhat exploratory step towards putting a premium on doing the job right and at the right time.

Of course, in the final analysis, from the industry's point of view, I think the real reward in reference to the development program in the right manner and the right time, is in getting the production contract thereafter. If he doesn't meet his schedule and misses out with the equipment, why, he just doesn't get the production contract, which has the real profit behind it.

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Brig. Gen. Stephen H. Sherrill, USA (Ret.)

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Brig. Gen. Stephen Huntting Sherrill, USA, 63, died of a heart attack at Walter Reed Army Hospital on June 28, 1956. A member of the West Point class of 1917, he was an officer in the Signal Corps from 1923 until his retirement in 1945.

In April 1946, General Sherrill was named Executive Secretary of the Army Signal Association, forerunner of the Armed Forces Communications and Electronics Association, and the first editor of SIGNAL.

To quote from the article which appeared in SIGNAL at the time of his resignation from that office in January 1950,

"One of the early planners in the organization of the AFCEA, General Sherrill undertook the executive administration of the Association when it got under way, in the beginning when there was much to be done and little to work with. The Association headquarters began its existence without even its own office, the first space being obtained by sharing the quarters of the Cavalry Association on Pennsylvania Avenue in Washington, D. C. At that location, equipment and a staff were gradually assembled, and the venture was begun.

"Through all the early days there were the onerous 'firsts' to be planned and carried through to accomplishment. Chapters had to be organized. National meetings had to be arranged—always a task involving great labor, but much more so when the Association was new and convention machinery was being set up for the first time.

"The Association's publication, SIGNALS, was yet unborn. And to plan and produce a brand new publication was in itself a considerable task.

"On the military side, the Association had begun as a Signal Corps group. So that when at the beginning of 1948 the Association name was changed and the other services came into the organization, another task developed in contacting the many people among those other services to make the numerous arrangements for the 'unification.'

"General Sherrill was devoted to the Association. He labored continuously to make of it what he though it should be, and he is mainly responsible for what it is today."

After leaving the AFCEA, General Sherrill became vice president of the First National Bank of Arlington, Va., and manager of its Armed Services Department in the Penatgon. He held this position at the time of his death.

A veteran of both World Wars, General Sherrill commanded Troop 1, Second Cavalry in four major engagements in the first World War. He later commanded the advance Cavalry of the 3rd Army which swept through Belgium, Luxembourg and into Germany. His unit was among the first of the American Army to reach the Rhine River in 1918.

For his supervision of the training of 64,000 radar specialists during World War II, General Sherrill was decorated with the Legion of Merit. During this period, he commanded the aircraft warning unit training center at Drew Field, Tampa, Florida. At the time of his retirement from active service, General Sherrill was the commandant of the Eastern Signal School at Fort Monmouth, N. J.

Between wars, General Sherrill attended the Command and General Staff School, Fort Leavenworth, Kansas and the Army War College in Washington, D. C. From 1939 to 1942 he was assigned to the Operations Division, General Staff, War Department.

Funeral services with full military honors were held on July 2nd at the Fort Myer Chapel, with twelve members of his West Point class as pall bearers. Burial was in Arlington National Cemetery.

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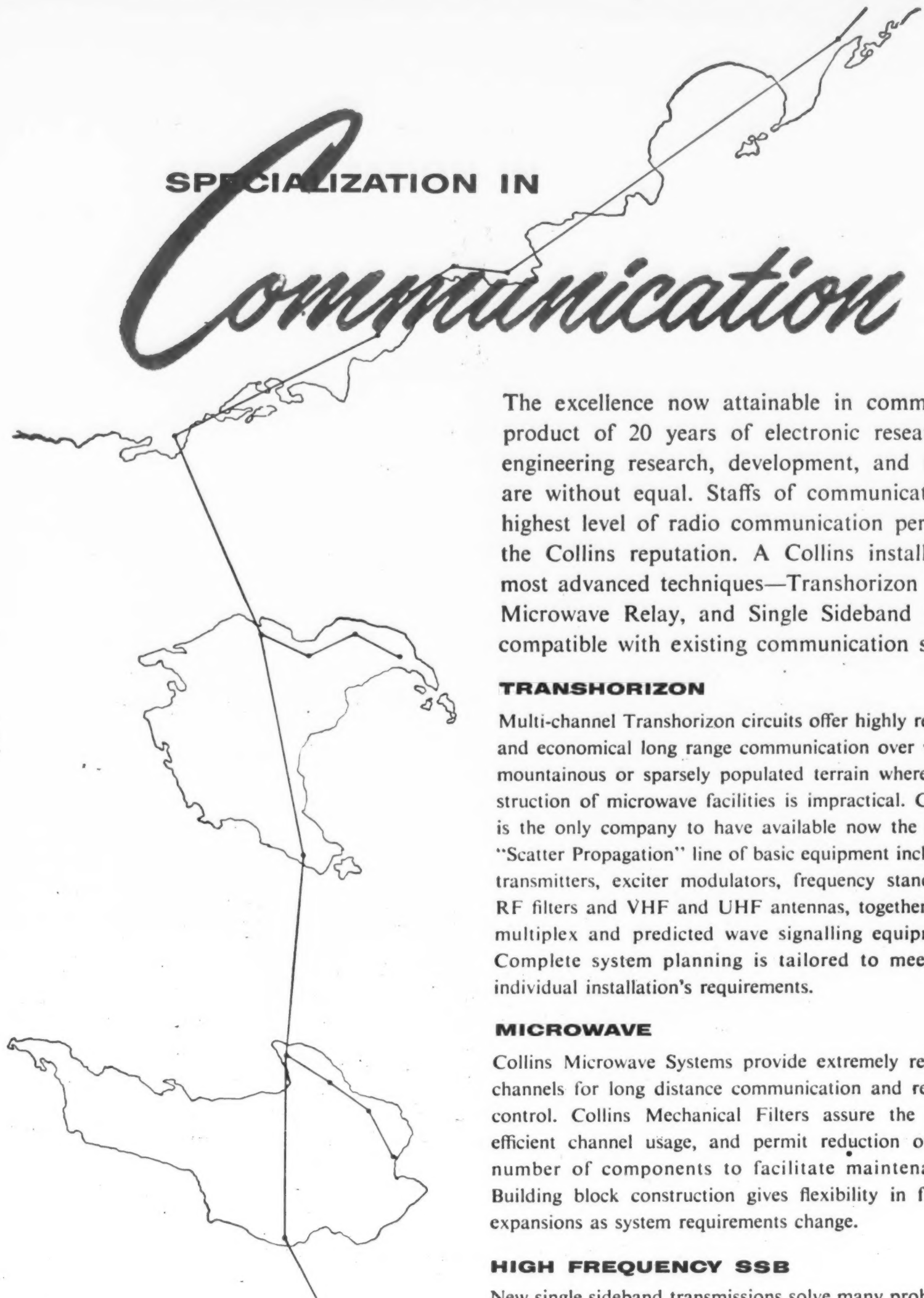

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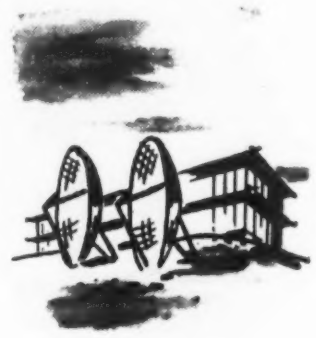
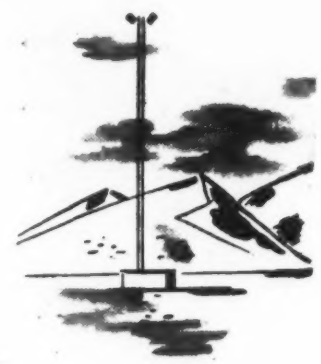


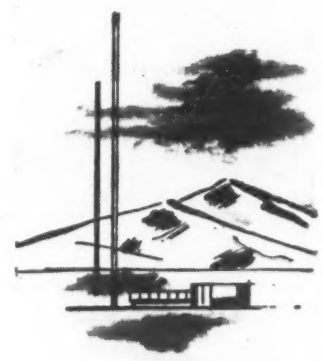
MICROWAVE

Collins Microwave Systems provide extremely reliable channels for long distance communication and remote control. Collins Mechanical Filters assure the most efficient channel usage, and permit reduction of the number of components to facilitate maintenance. Building block construction gives flexibility in future expansions as system requirements change.



HIGH FREQUENCY SSB

New single sideband transmissions solve many problems in HF communication. Concentrating RF power in the sidebands conserves spectrum space and reduces adjacent channel interference. Selective fading and interference problems of multipath transmissions are also minimized by SSB. Collins pioneering in SSB has produced the most advanced line in HF equipment.



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†Executive Committee Member, non-voting.

Association Affairs

AFCEA Service Academy Awards Presented

The Association's annual prizes at the Military and Naval Academies, portable radios, were donated this year by the Philco Corp.

The West Point award went to Frederick S. Holmes, Jr., the graduating cadet having the highest rating in the study of electricity. Maj. Gen. Francis L. Ankenbrandt, USAF, Director, Communications - Electronics, The Joint Chiefs of Staff, and a national drector of the AFCEA, made the formal presentation of the prize.

The Annapolis prize was won by Lyle M. Ishol, the graduating midshipman with the highest standing in the electronics course. National President Percy G. Black presented the award.

Look for AFCEA-ROTC Awards in the September-October issue.

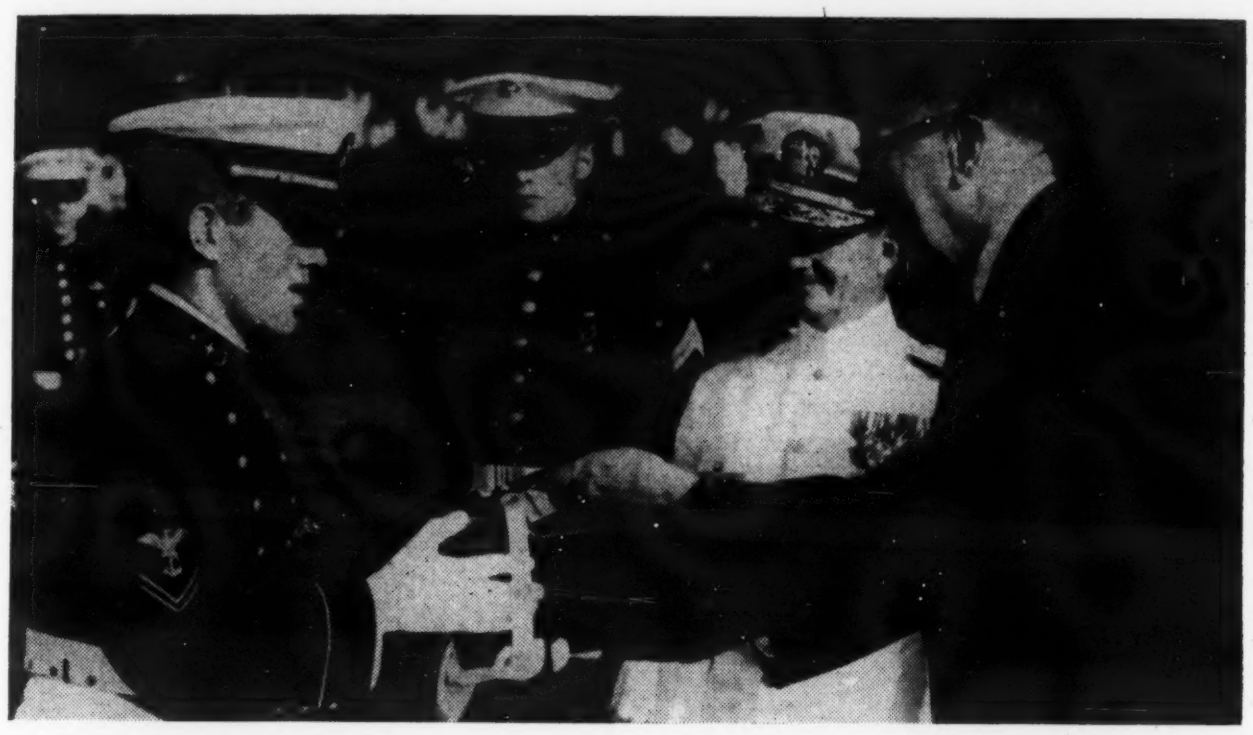
Introducing AFCEA's New Group Members

Lansdale Tube Company

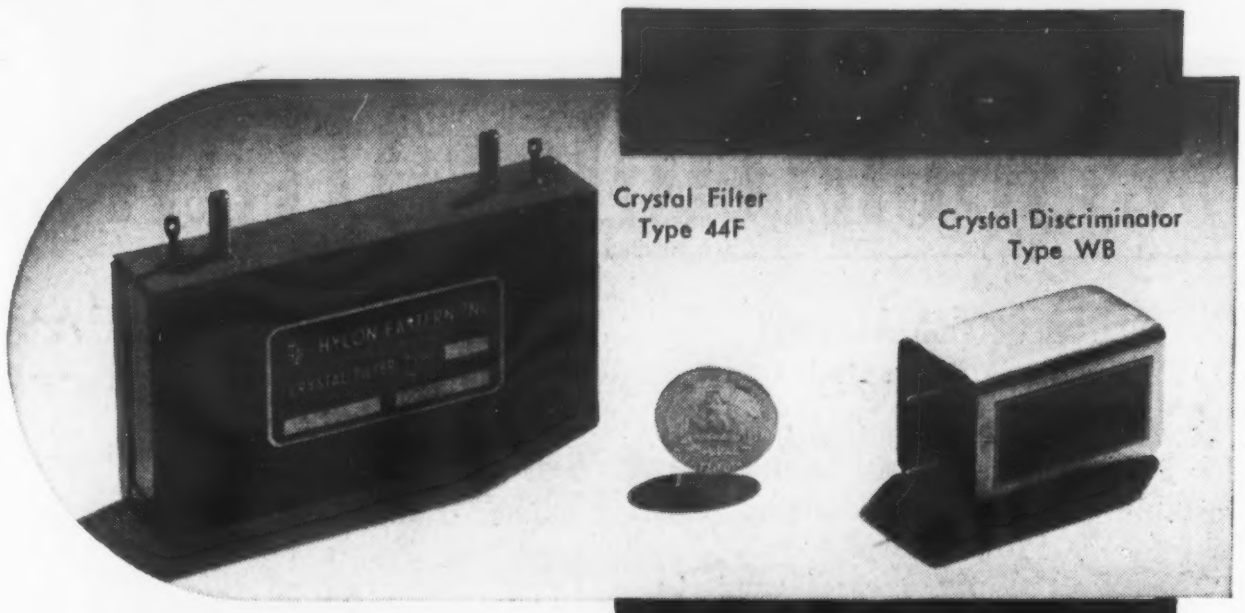
The Lansdale Tube Company, Lansdale, Pa., a Division of Philco Corporation, joined the Association in April. They are manufacturers of electronic tubes and semi-conductors.

Company representatives who will serve in the AFCEA are W. J. Peltz, vice-president and general manager; W. F. Maher, manager of government sales; C. H. Warshaw, manager of semi-conductor sales; H. K. Ishler, director of research and engineering; G. W. Pratt, chief engineer; W. P. Cole, section engineer; S. L. Parsons, executive engineer; A. E. Lyle, chief engineer, receiving tubes; R. J. Wells, engineering section head, and G. F. Barnett, project engineer.

(*Continued on page* 58)



Above, Percy G. Black, AFCEA National President, presents a portable radio to Lyle M. Ishol, winner of the AFCEA prize at the Naval Academy. At West Point (below), the presentation was made by Maj. Gen. F. L. Ankenbrandt, USAF, to Frederick L. Holmes, Jr.



for FM Reception by

Through the use of Piezoelectric resonators, filters are now available with extremely high selectivity at frequencies which eliminate the need for multiple conversions in VHF and UHF f-m receivers. The low insertion loss, linear transfer characteristic and non-microphonic quality of these filters permit their location at any point of low signal level such as between the mixer and the i-f amplifier. Using the Hycon Eastern Crystal Discriminator, Type WB, in combination with Crystal Filter Type 44F completely eliminates the need for any lower intermediate frequency. These filters can be produced on short notice in large or small quantities to meet *exact* performance requirements.

Write for Crystal Filter Bulletin

- SMALL SIZE
- HIGH SELECTIVITY
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- OPERATING TEMPERATURE: −55°C. TO +85°C.
- EXTREME STABILITY WITH VARIATIONS IN TEMPERATURE. FREQUENCY SHIFT LESS THAN ±.005% TOTAL FROM −55°C. TO +85°C.
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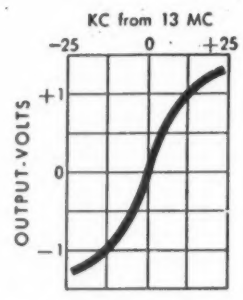
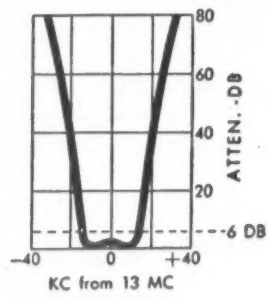
ELECTRICAL SPECIFICATIONS

Center Frequency 13 Mc (Available 10-20 Mc)
Bandwidth at 6 db Attenuation: 30 Kc (Available with 20-50 Kc Bandwidth)
Shape Factor: $\frac{\text{60 db Bandwidth}}{\text{6 db Bandwidth}} = \frac{1.7}{1}$ Maximum
Power Insertion Loss: 6db Maximum
Passband Response Variation: ± 1 db Maximum
Ultimate Attenuation: 80 db Minimum
Center Frequency Shift: ± 1 Kc





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Thomson-Houston Co. of France

Thomson-Houston Company of France, Paris, France, joined the Association in June.

Serving in the AFCEA as company representatives will be Maurice Jean, director, Electronics Group; Mario Sollima, director, Electronics Group; Emmanuel Courtillot, chief of technical orientation service, Electronics Group; Pierre Clavier, assistant to the engineer in chief, Electronics Group; Andre Moisson, engineer in chief, Technical Division, Electronics Group; Julien Vastel, chief of Air radar service, Technical Division, Electronics Group; Pierre Chavance, chief of communications service, Technical Division, Electronics Group; Julien Vastel, chief of Air service, Commercial Division, Electronics Group; Jacques Girie, chief of Navy service, Commercial Division, Electronics Group; Robert Simottel, chief of communications service, Commercial Division.

New AFCEA Chapter

Nagoya

Another overseas chapter was added to the list with the chartering of the Nagoya Chapter in Nagoya, Japan, early in May. Membership stems principally from the Fifth Air Force and industry representatives.

Officers of the chapter are: president—Col. Steve J. Gadler, Hq. Fifth Air Force, Operations, who has served as president of AFCEA's Dayton-Wright and European chapters; vice presidents—Col. R. W. Dickerson, Hq. 1809th AACS Group; Lt. Col. H. Ross, Hq. 5th Comm. Group; W. J. Sampson, Hq. Fifth Air Force, Materiel; treasurer—H. R. Heggen, Hq. Fifth Air Force, Operations; secretary—Craig D. Elderkin, RCA Service Co.

Committee chairmen are: program—W. J. Sampson; membership—Lt. Col. H. Ross; publicity—Lt. Col. Ralph Lamond, Jr.

Companies Accepted for AFCEA Group Membership Since May 1, 1956

†Compagnie Francaise Thomson-Houston
Paris, France

†The Lansdale Tube Co.
Lansdale, Pa.

*Le Materiel Telephonique Co.
Seine, France

†Brief notes about these companies appear in this issue.

*Brief notes about this company will appear in the next issue.

398 new AFCEA individual members from May 1 to July 1

A NEW DESIGN APPROACH . . .

Photograph of the earth from 100 mile altitude — Courtesy U. S. Air Force

. . . BEYOND-THE-HORIZON TRANSMISSION

BEYOND-THE-HORIZON TRANSMISSION

The newest military and commercial long-range communications systems are turning towards the advantages of "scatter" transmission. By transmitting *directly* to stations well beyond the horizon, scatter transmission systems eliminate the construction and maintenance of intermediate microwave stations and avoid cables and repeaters of wire systems, while retaining the wide bandwidths available at high frequencies. This *direct* transmission can span water or inaccessible terrain while giving predictably high signal reliability and freedom from interference.

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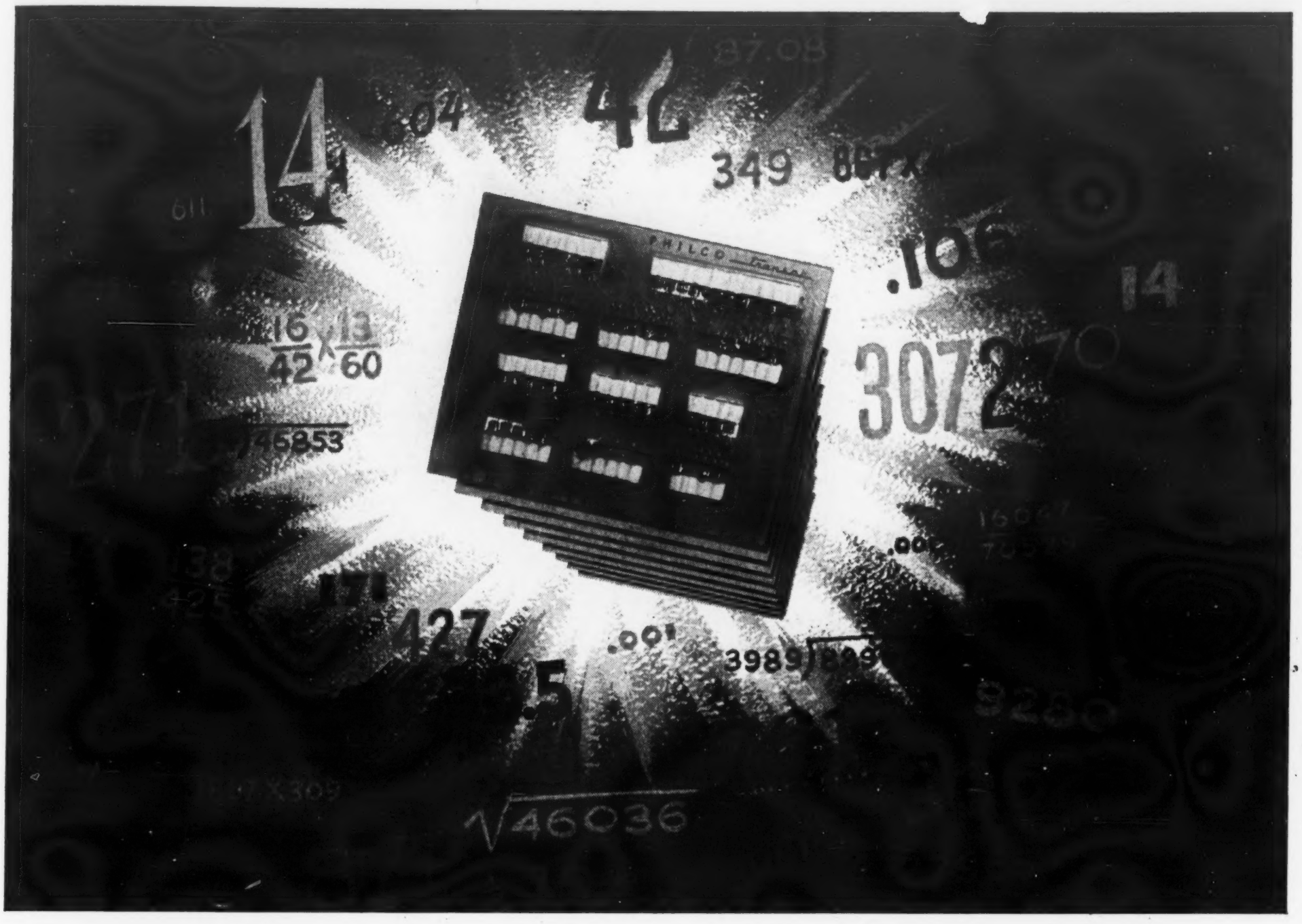

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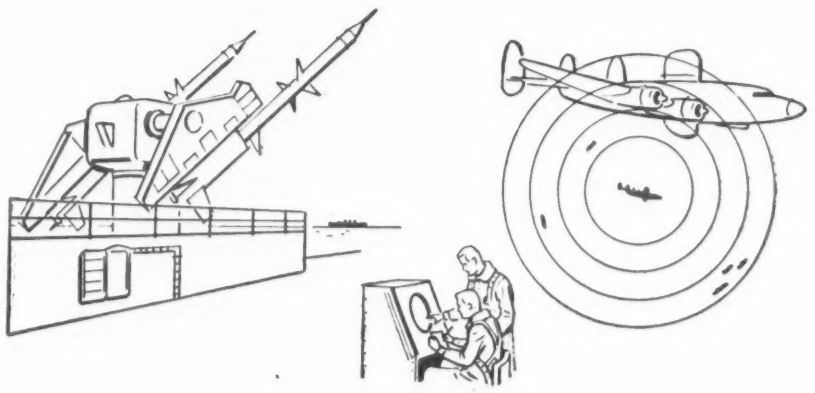

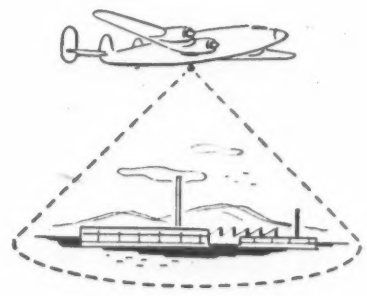

Out of Philco laboratories come far reaching developments in vital military electronic equipment to make a stronger U.S.A. on land, sea and in the air. Philco is proud to be working with the Armed Forces in all parts of the globe with a worldwide service organization of trained specialists.

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AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Admiral Corp.
Air Associates, Inc.
Aircraft Radio Corp.
Alden Electronic & Impulse Recording Equipment Co.
Allied Control Co., Inc.
Allied Radio Corp.
Almo Radio Co.
American Cable & Radio Corp.
American Electronic Laboratories, Inc.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Ampex Corp.
Amphenol Electronics Corp.
Anaconda Wire & Cable Co.
A. R. F. Products, Inc.
Argus Cameras, Inc.
Arnold Engineering Co.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Barker & Williamson, Inc.
Barry Controls, Inc.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Berkshire Transformer Corp.
Blackburn Electronic Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Clevite Transistor Products, Division of Clevite Corp.
Coastal Publications Corp.
Collins Radio Co.
Columbia Broadcasting System, Inc.
Contraves Italiana
Compagnie Francaise Thomson-Houston
Control Engineering Corp.
Convair, Division of General Dynamics Corp.
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Dana, P. A., Inc.
Designers for Industry, Inc.
DeVry Technical Institute
Diamond State Telephone Co.
Dictaphone Corp.
Dukane Corp.
DuMont, Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Elgin Metalformers Corp.
Espey Manufacturing Co., Inc.
Fairchild Camera & Instrument Corp.
Farnsworth Electronics Co.
Federal Telecommunication Laboratories
Federal Telephone & Radio Co.
General Aniline & Film Corp.
General Cable Corp.
General Communications Co.
General Electric Co.
General Telephone Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Haller, Raymond and Brown, Inc.
Hallicrafters Co.
Haloid Co.
Hammarlund Manufacturing Co., The
Hazeltine Electronics Corp.
Heinemann Electric Co.
Hercules Motor Corp.
Hitemp Wires, Inc.
Hoffman Laboratories, Inc.
Holtzer-Cabot Division, National Pneumatic Co., Inc.
Hoover Electronics Co.
Hopkins Engineering Co.
Hughes Aircraft Co.
Hycon Eastern, Inc.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
International Business Machines
International Resistance Co.
International Telephone & Telegraph Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Kay Lab
Kellogg Switchboard & Supply Co.
Keystone Electronics Co.
Kleinschmidt Laboratories, Inc.
Lansdale Tube Co., Division of Philco Corp.
Lavoie Laboratories
Leich Sales Corp.
Lenkurt Electric Co.
Lenz Electric Manufacturing Co.
Lewyt Manufacturing Corp.
Librascope, Inc.
Loral Electronics Corp.
Machlett Laboratories, Inc.
Magnavox Co.
Maida Development Co.
Mallory, P. R., & Co., Inc.
Marion Electrical Instrument Co.
Materiel Telephonique Co.
Merit Coil and Transformer Corp.
Michigan Bell Telephone Co.
Microwave Associates, Inc.
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New York Telephone Co.
North American Philips Co., Inc.
North Electric Co.
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Co.
Otis Elevator Co., Electronic Division
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
Packard-Bell Co.
Page Communications Engineers, Inc.
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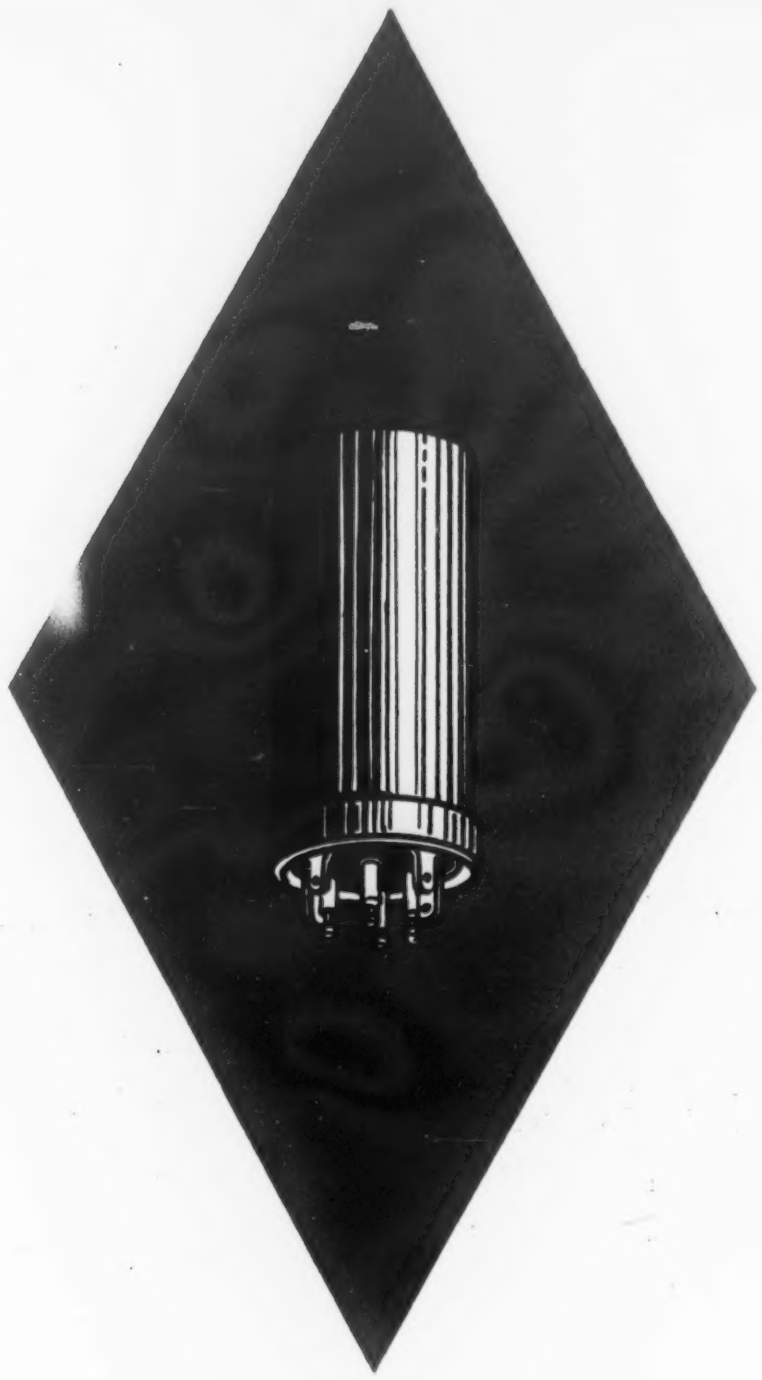
Phelps Dodge Copper Products Corp.
Philco Corp.
Photographic Society of America
Plessey Co., Ltd.
Prodelin Inc.
Radiart Corp.
Radio Condenser Co.
Radio Corporation of America
Radio Corporation of America, Defense Electronic Products
RCA Great Britain, Ltd.
Radio Engineering Laboratories, Inc.
Radio Receptor Co.
Raymond Rosen Engineering Products, Inc.
Raytheon Manufacturing Co.
Red Bank Division, Bendix Aviation Corp.
Reeves Instrument Corp.
Remington Rand, Division of Sperry Rand Corp.
Remler Co., Ltd.
Rocke International Corp.
Saxonburg Ceramics
Sigma Instruments, Inc.
Society of Motion Picture & Television Engineers
Sonotone Corp.
Soundscriber Corp.
Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co.
Southwestern Bell Telephone Co.
Sparton Radio-Television Division, Sparks-Withington Co.
Sperry Gyroscope Co., Division of Sperry Rand Corp.
Sprague Electric Co.
Stackpole Carbon Co.
Standard Coil Products Co., Inc.
Standard Engineering & Manufacturing Co.
Standard Telephone & Cables, Ltd.
Stanford Research Institute
Stelma, Inc.
Stewart-Warner Corp.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
Sylvania Electric Products, Inc.
Technical Materiel Corp., The
Technology Instrument Corp.
Telephone Services, Inc.
Telephonics Corp.
Teletype Corp.
Tensolite Insulated Wire Co., Inc.
Texas Instruments, Inc.
Times Facsimile Corp.
T.M.C. (Canada) Ltd.
Trad Electronics Corp.
Triad Transformer Corp.
Transitron Electronic Corp.
Tung-Sol Electric, Inc.
United Telephone Co.
United Transformer Co.
Wac Engineering Co.
Waterman Products Co., Inc.
Webster-Chicago Corp., Government Division
West Coast Telephone Co.
Western Electric Co., Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Wheelock Signals, Inc.
Whitney Blake Co.
Wickes Engineering & Construction Co.
Wilcox Electric Co., Inc.
Wisconsin Telephone Co.
Wollensak Optical Co.
Yale & Towne Manufacturing Co., Powdered Metal Products Division
Zenith Radio Corp.



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Chapter News

Arizona

The chapter holds regular monthly meetings which feature a technical speaker. It has proved advantageous, due to the isolation of the post and the relatively small membership, to hold joint dinners and technical sessions with the local IRE sub-section. Official business is transacted separately. This expedient of joint scheduling has provided sizable audiences as well as speakers of high caliber.

The March 21st meeting was addressed by Pinckney B. Reed, vice president, RCA Service Co., who discussed reliability of electronic equipment, with emphasis on RCA's experiences. His talk was illustrated with a color film on the instrumentation installed by RCA at Banana River, Florida.

Dr. W. A. Edson, consulting engineer for the General Electric Co. Microwave Laboratory at Stanford Industrial Park, Palo Alto, California, was the guest speaker at the April 12th dinner-meeting.

Dr. Edson presented an illustrated lecture covering recent developments in high-gain, low-noise microwave amplifiers. Among the new components described were: a traveling-wave tube capable of amplifying over a two-to-one frequency range; microwave amplifiers capable of amplifying wave-lengths in the order of four millimeters, and klystrons with power gains of one billion. A brief discussion of foreign developments, such as the carcinotron or backward wave tube, was also given. Dr. Edson pointed out that the state of microwave tube progress was practically at the same point in England, Europe and the United States.

"Telephone Transmissions for the Future" was the subject of a talk delivered by Byron C. Brummer, AT&T communications engineer, at the May meeting. Mr. Brummer described improvements in telephone transmission during the past thirty years and emphasized requirements necessary to serve a large number of future communications services.

Lt. Col. Clarence O. Coburn was named secretary of the chapter to succeed Frank A. Carollo who had been transferred. William S. Marks, Jr., new Chief Scientist of the Army Electronic Proving Ground, was elected to the board of directors.

Chapter of the Year Contest

The North Texas Chapter was named 1955-56 Chapter of the Year at the annual banquet during the national convention in Boston. In the four categories of the chapter contest, North Texas had placed first in three of them—the highest percentage of new members, the highest percentage of renewals, and the maximum number of regular meetings.

Certificates were also awarded to the following chapters: Fort Monmouth for enrolling the largest number of new members, Augusta-Fort Gordon and South Texas for holding the maximum number of regular meetings.

The Chapter of the Year plaque was presented to Howard L. Housley, who had served as president of the North Texas Chapter during the 1955-56 fiscal year.

Atlanta

Charles M. Eberhart, Georgia commercial manager for the Southern Bell Telephone and Telegraph Co., was elected president of the chapter at the May 8th meeting. In 1952, he served as president of the Augusta-Camp Gordon Chapter.

Other new officers are: 1st vice president—Jack Evans, Western Union; 2nd vice president—Lt. Col. Donald L. Adams, Third Army Hqs.; 3rd vice president — Robert J. Smith, Atlanta General Depot; 4th vice president — William F. Johnson, Georgia Tech.

Col. A. R. Morley, outgoing president, was presented a gold AFCEA lapel button in recognition of his splendid leadership during the past year.

Distinguished speaker of the evening was Lt. Gen. Thomas F. Hickey, Commanding General, Third Army, who discussed the Army's role in the national defense structure. "From the Minute Men of 1776 to Heartbreak Ridge and the Iron Triangle, the Army has been the same in one major respect," he said. "It is made up of small corps of professionals, backed by a reserve."

General Hickey stated that the task of the Army in 1776 was to win freedom, and now it is to defend that freedom. He pointed out that, today, defense or offense is not limited to one weapon and that the Army must be ready for aggression or attack, and must be ready to fight with or without the A-bomb.

The General referred to the Army as the largest business in the country, with 1,025,000 soldiers and 450,000 civilians, as compared to 150,000 officers and men in pre-Pearl Harbor days. He also said the Army man of today is part of a $40 billion dollar business.

Discussing the responsibilities of the Army, General Hickey said that today 40% of the active Army is overseas, acting as a deterrent to the Iron and Bamboo Curtains. In Europe, our Army serves as our NATO representative and in Korea, the Army is ready to resist aggression if need be. Personnel of the Army today are training 200 Allied divisions. The 60% at home furnish AA defense, maintain schools, recruit and train the reserves, among other duties.

Arizona: Shown in photo at left are Pinckney B. Reed, vice president, RCA Service Co., guest speaker at the March meeting, and Col. Kirk Buchak, chapter president. Scene at right shows members participating in a demonstration of telephone transmission conducted by Byron C. Brummer (second from left), AT&T communications engineer.

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CHAPTER NEWS

"Such an organization requires a large logistic establishment," said the speaker. "We must also continually keep research and development in mind. The implementation of policy must be kept up to date.

"For the first time in history we have a strong reserve," he said. "The forces of our Army in being must be well trained and equipped. They must have appropriate anti-aircraft and other weapons. There is no need to use a guided missile if a rifle suffices. The deadly NIKE is now located on sites protecting our most important cities.

"Our Army is ready to fight if need be," he said. "to give victory for a short war or long war, atomic or non-atomic. Our common purpose is to meet the demands put on it by the people. To defend the United States we know that we must have the support of the citizenry."

Atlanta's May meeting was addressed by Lt. Gen. Thomas F. Hickey, Commanding General, Third Army. Left to right: Ben S. Gilmer, vice president-operations, Southern Bell; General Hickey; J. G. Bradbury, executive vice president, Southern Bell, and Col. A. R. Morley, retiring president of the chapter.

Augusta-Fort Gordon

Louis C. Harris, executive news editor of the *Augusta Chronicle and Herald*, addressed the April 19th dinner-meeting on the "History of the Written Word." After tracing man's development of communication from cave drawing to our modern mass circulation newspapers, Mr. Harris re-emphasized communications' dependency on the written word.

Meeting at Timmerman's Restaurant in Augusta, the sixty-some members present were introduced to Col. Ernest T. Lundesgaard, Chief Signal Officer of the Norwegian Army, who was then in the midst of a tour of the Signal Corps Training Center at Fort Gordon.

Using illustrated charts, Mr. Harris entertainingly told the story of words in communication. He pointed out that it was thousands of years between man's invention of a weapon to the time when man developed a written communication. But, he said, it took only 35 years for the printed word, once developed, to spread in use throughout Europe. The latest developments in news printing were explained. Mr. Harris pointed out that the utilization of new methods in photo-engraving will allow, in the near future, a newspaper to be printed in a matter of minutes instead of hours.

Chapter President J. C. Woodward, Jr., led the group in a farewell tribute to two departing members—Walter O. McDowell, Augusta district manager for Southern Bell, who was transferred to the Atlanta offices of the company, and Col. George W. Rhyne, deputy chief of staff, SCTC, leaving for a new assignment as Signal Officer of the Third Army.

Guest speaker at the May 14th meeting was Scott Nixon, vice president of Southern Finance Corp. Mr. Nixon, a former member of the Augusta City Council and active in Augusta Civic Club work, chose as his subject, "Cities of Augusta."

He informed the group that there are twenty-two cities in the United States named Augusta and that he had visited all of them. After a brief account of the size and location of these Augustas, he concluded his program with a film taken while visiting these cities.

Baltimore

The Westinghouse Electric Corporation, Air Arm Division, was host to the chapter members and guests on April 24th at Friendship Airport. Following a dinner meeting in the Westinghouse Cafeteria, the group participated in a conducted tour of the Air Arm Division facilities.

The United States Coast Guard invited the chapter to visit their Curtis Bay facilities on May 16th. The program began with a guided tour of the main waterfront and included a visit to the weather-decks of the Coast Guard vessel *Yakutat*. After dinner, a film entitled "Coast Guard Officer" was shown. A conducted tour of the electronics shop concluded the evening's activities.

Augusta-Fort Gordon: Shown at April 19th meeting, left to right: J. C. Woodward, Jr., new chapter president; Louis C. Harris, executive news editor, *Augusta Chronicle and Herald*, guest speaker; Col. Ernest T. Lundesgaard, Chief Signal Officer of the Norwegian Army, and Walter O. McDowell, Southern Bell.

Central Florida

The June meeting was held on the 7th at the studios of the Burdett Sound and Recording Co. of Tampa.

During the business session, the following regular officers were elected for 1956-57: president—Willard L. Moor, director, Electronics Training Program, University of Tampa, and head of the I.G.E.I. Electronics Training Program; 2nd vice president — T. H. Landgraf, special consulting engineer, Peninsular Telephone Co.; treasurer—Lt. Col. Russell R. Randell, AUS (Ret.)

Allen G. Burdett gave an informative and entertaining talk on the latest developments in hi-fidelity sound recording and reproduction equipment and video tape recording. He concluded his presentation with a demonstration of stereophonic sound.

Refreshments were served by the host at the conclusion of the program.

Chicago

Henri G. Busignies, executive vice president of Federal Telecommunication Laboratories, presented an illustrated lecture on TACAN at the chapter's April 11th dinner-meeting. The Kellogg Switchboard and Supply Co. was host for the occasion.

Mr. Busignies described the development and uses of TACAN, the tactical air navigation system originally developed for the Navy and Air Force, which now promises to make commercial flying even safer.

National President George W. Bailey also addressed the gathering and outlined plans for the annual convention.

Held at the Clearing Industrial Club, the meeting was attended by two hundred members and guests. A social hour preceded the dinner.

Dayton-Wright

Brig. Gen. Alvin L. Pachynski, then Deputy Director of Communications-Electronics, USAF, delivered the principal address at the March 28th dinner-meeting. His subject was "What Price Frequencies."

The meeting took place at the Wright-Patterson Air Force Base Officers Club and was preceded by a cocktail party in honor of General Pachynski. One hundred and fifty members and guests were present.

General Pachynski's talk will be included in the September-October issue of SIGNAL.

Detroit

The annual election of officers was held on May 14th with the following result: president — Joseph H. Swartz, Seneca Electric Co.; first vice president —Col. James I. Vanderhoof, Director of Communications, 30th Air Division; second vice president—Harry B. Rottiers, Burroughs Corp.; third vice president — R. A. Berkfield, Michigan Bell; treasurer—J. H. White, Michigan Bell; assistant treasurer—K. C. Crumb, Michigan Bell; secretary—J. R. Saxton, Michigan Bell; assistant secretary — H. A. Dawson, Michigan Bell.

On May 17th, the chapter scheduled a tour of the guided missile site in the Detroit area. Hosts were Lt. Col. Rolland D. Appleton and Capt. Dorius Galipeau, assisted by the enlisted personnel stationed at the NIKE site.

First on the program was a visit to the launcher site where the features were explained together with the functions of personnel and equipment. A dinner in the mess hall was followed by a similar tour of the control area, which was supplemented by a film on the development of missiles.

Captain Galipeau then presented a classroom discussion of the main features of the missile and its operation, and opened the meeting to a lively question and answer period. Attendance was excellent and the chapter reports the program stimulated so much interest that the discussion could have run on considerably past the scheduled time for adjourment.

Fort Monmouth

Guest speaker at the April 19th meeting was Mr. S. D. Page of the New Jersey Bell Telephone Co. who presented a lecture-demonstration on "Crystals and Magnets."

It was announced that at the April 4th meeting of the Board of Directors, John W. Wopat was elected second vice-president to succeed Dr. E. G. Witting, who was transferred to Washington, and that Halsey F. Hubbard, SCEL, was elected a director to re-

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place William S. Marks, Jr., who was transferred to Fort Huachuca (where he was elected a director of the Arizona Chapter).

The dinner was attended by 125 members, with additional members and guests attending the program portion of the evening.

Gulf Coast

Maj. Gen. Gordon A. Blake, then Director of Communications - Electronics, USAF, was the featured speaker at the May 3rd dinner-meeting. He highlighted the aims and objectives of membership in the AFCEA and stressed the advantages of participation in its activities.

Discussing the career opportunities of officers in the communications-electronics field, General Blake pointed out the broad application of electronics in modern warfare and the need for men with these skills. He then showed a film which he had brought to the meeting entitled "Strategic Communications Systems."

At its June 4th meeting, the chapter voted to initiate a program for stimulating the interest of local youth in communications and electronics. The program will begin in the Fall and will be of a continuing nature. It will have three principal phases:

1. The chapter will sponsor a conducted tour for local high school students through the communications and electronics facilities at Keesler Air Force Base.
2. The chapter will sponsor a conducted tour for local high school students through the local Bell Telephone plant.
3. The chapter will offer to furnish guest speakers on various communications-electronics subjects to the local high schools.

President Don Poling appointed the following committee to start the planning on the project: George A. Teunisson, Southern Bell T&T Co., to represent the local electronics industry; CWO Jack Nolan of Keesler AFB to represent the local military electronics field; Lt. Col. Charles A. Bell, Keesler AFB, to represent the Electronics School at Keesler AFB, and Capt. Arden C. Wizeman of Keesler AFB, to represent the military wired communications area.

President Poling further reported that, as an initial effort along this line, he and Capt. Robert B. Miller, chapter treasurer, had conducted a discussion on communications-electronics with the senior class at the Gulfport High School.

Other highlights of the June meeting were reports on the events of the national convention in Boston by President Poling and Captain Miller, who had attended as chapter delegates.

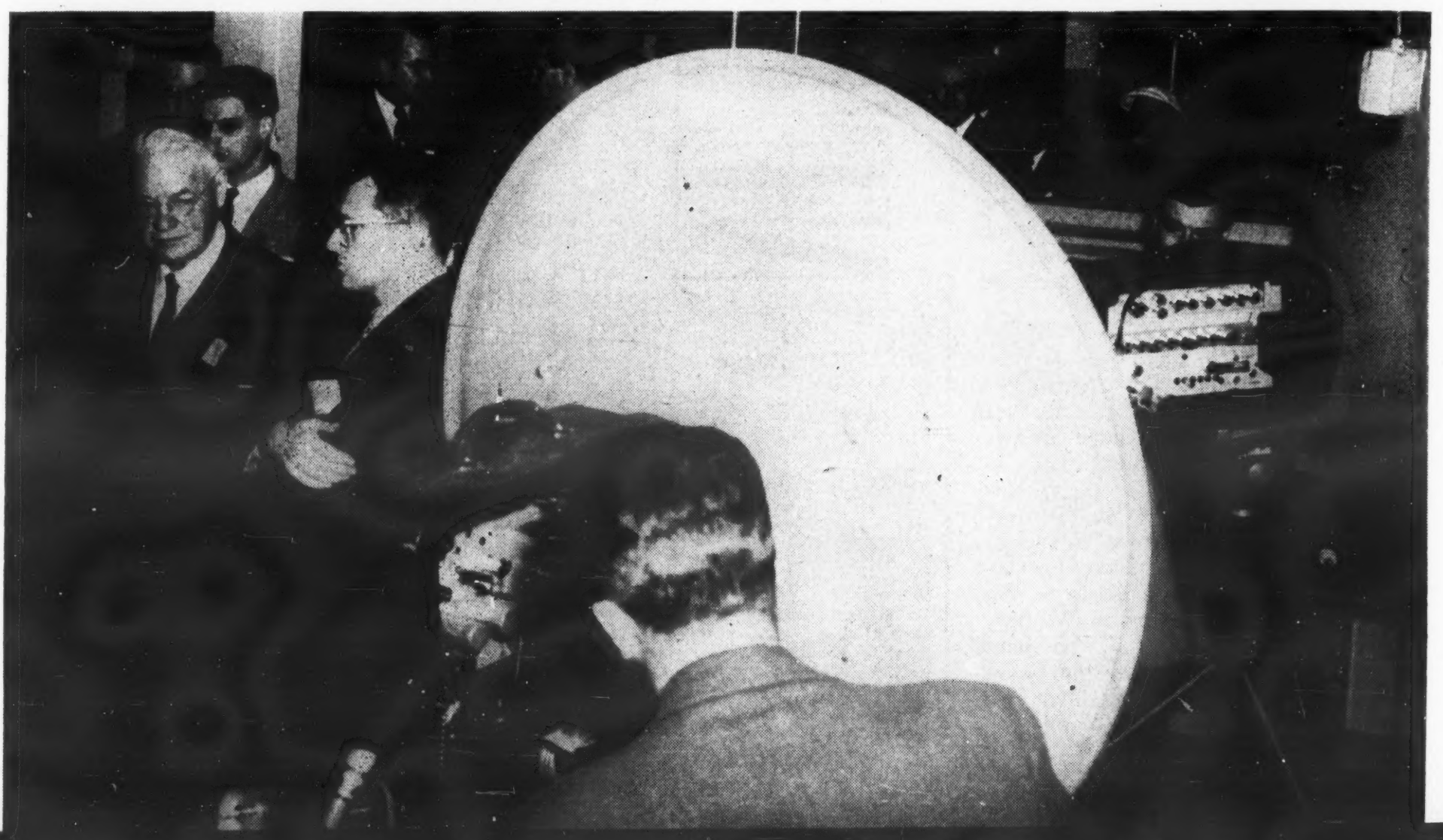
Dayton-Wright's March meeting was addressed by Brig. Gen. A. L. Pachynski, then Deputy Director of Communications-Electronics, USAF. Shown at the head table, left to right, are: Col. C. H. Lewis, chapter director; General Pachynski; Robert J. McIlrath, chapter president, and Lt. Col. J. R. Byrtus.

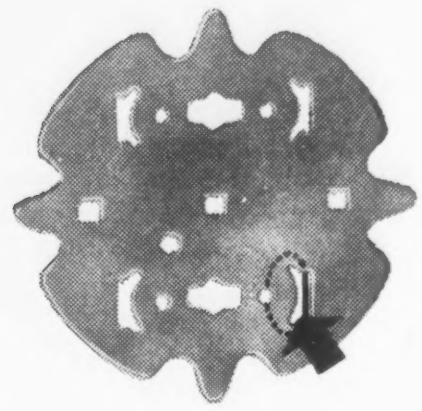
Hawaii

Activities of the last few months included a tour of the Naval Radio Station at Lualualei, Oahu, in March; a dinner-dance at the Fort Shafter Officers Club in April, and the annual business meeting with election of officers at a luncheon at Fort Shafter on May 24th.

The newly elected officers for 1956-57 are: president — Col. Glenn S. Meader, USA; 1st vice president—Lt. Col. Michael F. Killian, USAF; 2nd vice president—Ken W. Murray, NavCommSta; 3rd vice president—Robert S. Lowrey, Hawaiian Telephone Co.; secretary—Jack R. Reed, Automatic Electric Co.; treasurer—Ira G. Mercer, Radio Station KHON.

Boston: Members learned about Raytheon's new microwave link, KTR-1000B, during a recent guided tour through the firm's new Wayland engineering laboratory. Lightweight and portable, the relay transmits both TV picture and sound simultaneously. Use of the link makes possible remote pickups from distant points, eliminating need for cable connections.





Left: G-E 5-Star subminiature tubes on life test are checked for resistance to inter-element leakage. Minimum resistance requirement on critical types after 500 hours is 50,000,000 ohms. **Above:** how mica slots of original G-E design greatly lengthen plate-to-grid leakage paths. Arrow points to one of four curved barrier slots in the tube mica spacers. These prevent leakage currents from flowing over the shortest path between the plate support (vertical black line) and grid support (circle). Instead, leakage (dotted lines) must follow long paths around the ends of the slot, where higher resistance is met.

Slotted micas in G-E 5-Star subminiatures combat inter-element leakage; increase tube reliability!

WHERE it is important to ward off plate-to-grid leakage —as in certain of the twin triodes—G-E 5-Star subminiatures have slotted mica spacers of original design that act as efficient safeguards. These slots lengthen the paths that leakage currents must take through deposits of any conductive substances on the micas. Resistance is greatly increased.

Tube electrical leakage can seriously impair the dependability of military electronic equipment. Noisy, unclear signal reception . . . . . erroneous instrument readings . . . . . these and other faults may develop. The new anti-leakage slots designed into G-E 5-Star subminiature micas bring added trustworthiness to critical tube sockets—an important "plus" for those who operate and maintain field and airborne equipment.

Anti-leakage slots are only one of many special design features that join to give G-E 5-Star subminiatures top reliability and long life—the prime objectives of General Electric's 5-Star program. To special tube design, add high-precision manufacture under dust-free, lint-free conditions, and rigid and extensive tube testing.

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CHAPTER NEWS

London

The May 29th meeting was held at the U. S. Air Force's Columbia Club, London, with the annual election of officers the main item of business.

The new officers are: president — Capt. Edward F. Metzger, USN; vice-presidents — Capt. F. C. B. Jordan, USN; Col. W. W. Bailey, USAF; Lt. Col. J. T. Tyler, USAF, and Lt. Col. N. H. Fertig, USAF; associate vice-presidents — Eric Ball, T. E. Goldup, Vice Adm. J. W. S. Dorling, and Brigadier L. H. Harris, CBE; secretary—Maj. Russ C. Foss, USA; associate secretary—L. T. Hinton; treasurer—Capt. H. W. Gipple, USAF; associate treasurer—P. D. Canning.

It is interesting to note that Captain Metzger served as a director of the Chicago Chapter and Captain Jordan was president of the Tokyo Chapter, both in 1954-55.

Following the business meeting, the chapter was addressed by Sir Harold Bishop, Kt.C.B.E., technical director of the British Broadcasting Co. and president of the British Radio Industries Club. Sir Harold discussed the development of BBC, both in radio and television, compared the British position and policies with the U. S. situation, and outlined the policies and prospects of BBC for the future. With his background in the industry and in the Government, Sir Harold was able to give an authoritative talk which was of pertinent interest to all the members.

Louisiana

LCdr. Delmar L. Canady, USN, Aviation Technical Training Officer, addressed the April 16th meeting at the Naval Air Station. His subject was "Your Problems Can Be Solved by Training" which covered a discussion on the problems of communications as experienced by Surface and Air Naval Reserve.

New York

The International Business Machines Corp. was host to the chapter on April 25th and presented a program on "Electronic Data Computers and Their Applications."

John C. McPherson, IBM Vice President, welcomed the 250 members and guests and then introduced the following panel of speakers: P. A. Beebe, Military Products Division, Kingston; G. L. Kennard, Vestal Airborne Computer Laboratory, and D. W. Pendery, IBM headquarters.

The panel presented a series of talks and illustrations on the development and application of electronic computing and data processing equipment and their military and commercial applications. After the meeting, the members were shown demonstrations of the various IBM machines.

Chicago's April meeting was visited by AFCEA President George W. Bailey (second from right). Appearing with him, left to right: IT&T vice presidents John Gingrich and Fred Wilson; Henri Busignies, vice president, Federal Telecommunication Laboratories, principal speaker; James H. Kellogg and George T. Scharffenberger, president and vice president of Kellogg Switchboard and Supply Co.

North Texas

The chapter's April 17th meeting was held in honor of National President George W. Bailey who reported to the members on the national activities of the Association.

Collins Radio Company in Dallas was host to eighty members and guests on May 28th, with a tour of the plant as the highlight of the meeting. Mr. C. Frank Seay, Jr., Staff Engineer, welcomed the group and introduced the various guides who were to conduct the tour. The chief of production gave a brief review of the overall operation of the Products Division and the equipments currently in production. This was followed by a color film on Collins' Range and Glide Path Approach equipment for landing aircraft.

After the film, the chapter spent an hour and a half touring the main production plant, then went to the engineering building and spent an additional hour touring and discussing "engineering for production."

Paris

During a visit last February to the Pentagon, Chapter President J. R. Pernice arranged with the Director of Communications-Electronics, USAF, to obtain a copy of the unclassified version of the SAGE film on air defense for presentation before the Paris Chapter. This presentation took place at the May 28th dinner-meeting at the Cercle Militaire.

Extraordinary interest in the SAGE story was expressed in Government, military and industrial circles, and some 175 persons attended the film showing in a special auditorium of the Cercle Militaire. A cocktail party and dinner followed the film.

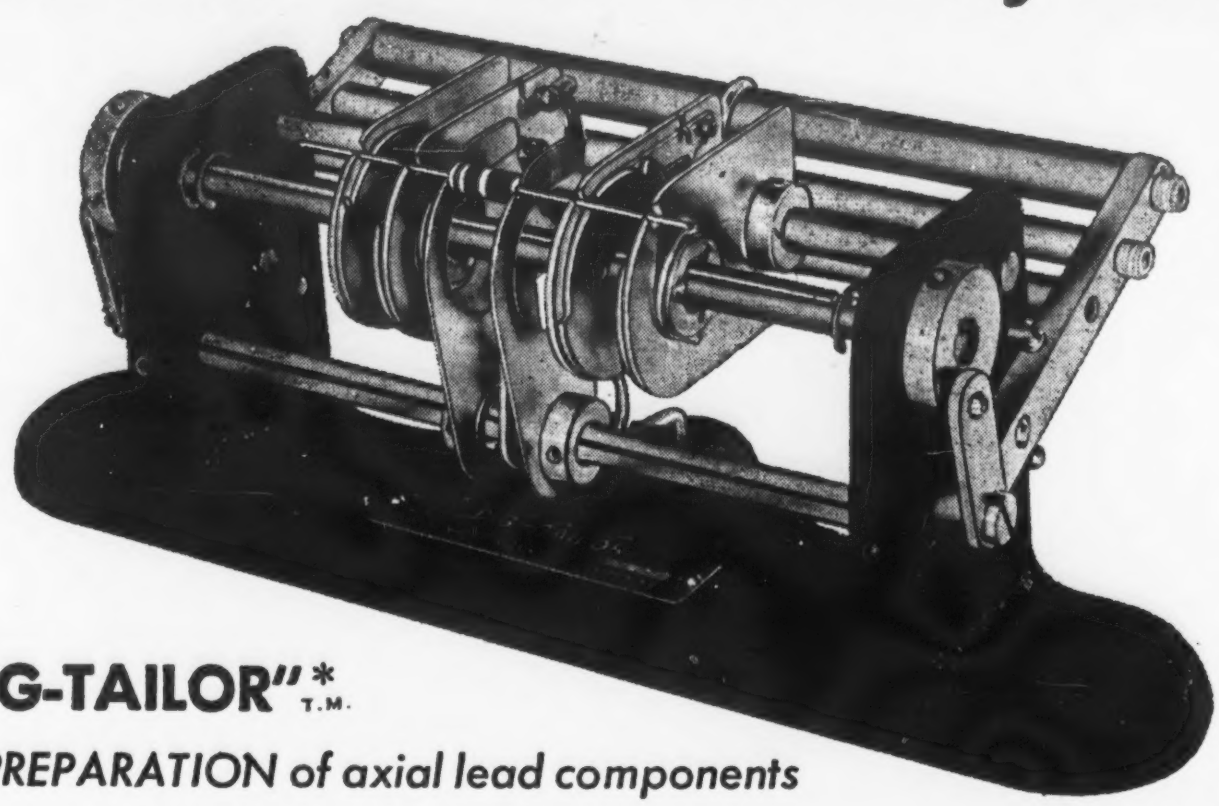
After an introductory address by President Pernice, a short talk on SAGE was given by Mr. R. G. Clark within the framework of the material presented in the film. Mr. Clark was connected with the Lincoln Laboratories between 1951 and 1956 and is now associated with the SHAPE Air Defense Technical Center at The Hague.

The dinner-meeting was attended by officers of SHAPE, EUCOM, AFCENT and officers of the French Army, Navy and Air Force. Also present were members of the International Staff of NATO and representatives of the German and American delegations of NATO. Mr. J. Murray Mitchell, Assistant Secretary General for Production and Logistics, NATO, and representatives of the Danish, Portuguese and Turkish delegations of NATO were unable to stay for the dinner but attended the film showing and cocktail party.

Representatives of the following com-

Gulf Coast: Maj. Gen. Gordon A. Blake, USAF (center), then Director of Communications-Electronics, USAF, was principal speaker at the May 3rd meeting. With him are, left to right: Col. William N. Snouffer, Keesler AFB; Ancil Z. Arseneau, vice president; Maj. Donald L. Poling, president, and Capt. Robert B. Miller, treasurer.

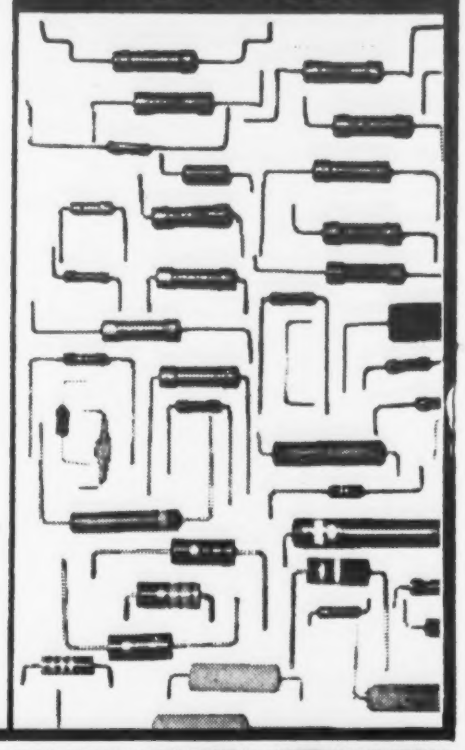
PROVEN-on the assembly line!



"PIG-TAILOR"* T.M.

For PREPARATION of axial lead components

PREPARED COMPONENTS IN SECONDS WITH THE "PIG-TAILOR"



"PIG-TAILORING"

. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.

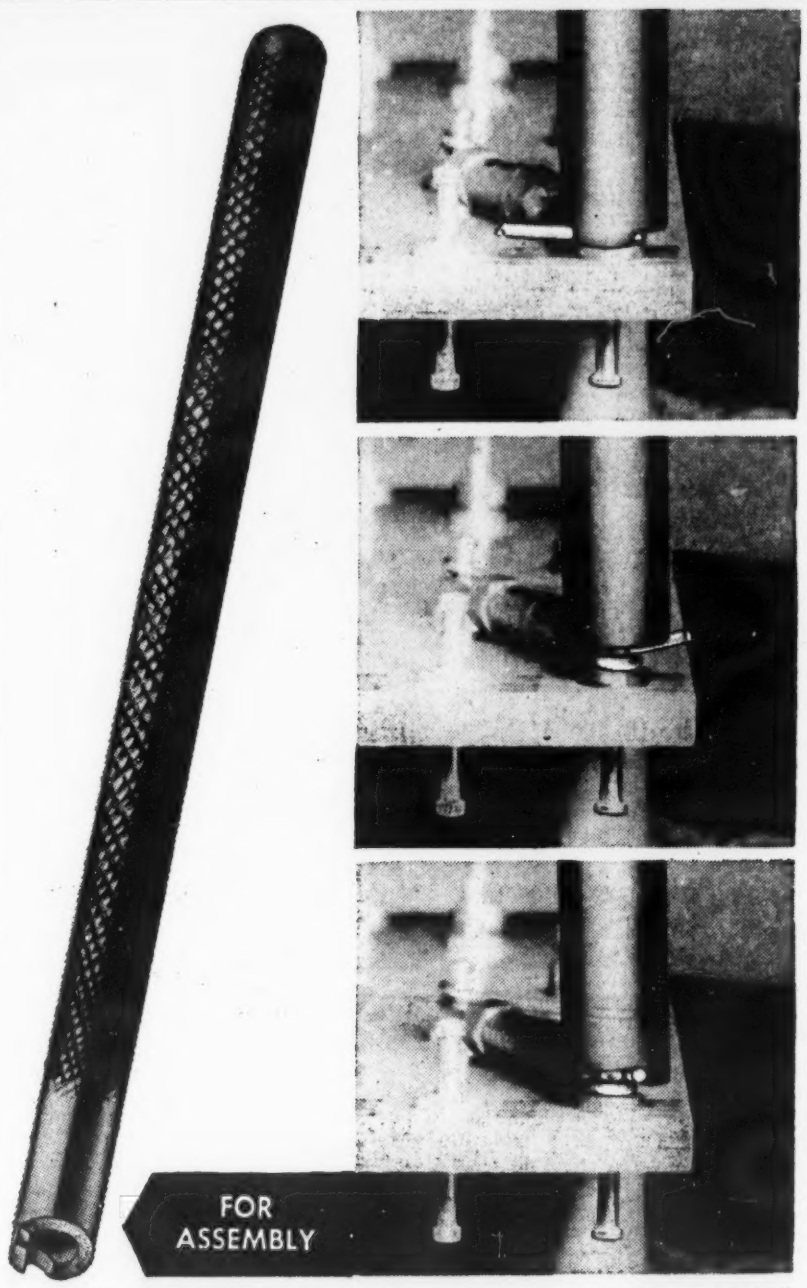
The "PIG-TAILOR" plus "SPIN-PIN"—accurately MEASURES, CUTS, BENDS, EJECTS & ASSEMBLES both leads simultaneously to individual lengths and shapes—3 minute set-up—No accessories—Foot operated—1 hour training time.

PIG-TAILORING provides:

1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits.
6. Individual cut and bend lengths.
7. Better time/rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery.

PIG-TAILORING eliminates:

1. Diagonal cutters!
2. Long-nose pliers!
3. Operator judgment!
4. 90% operator training time!
5. Broken components!
6. Broken leads!
7. Short circuits from clippings!
8. 65% chassis handling!
9. Excessive lead tautness!
10. Haphazard assembly methods!



"SPIN-PIN"* T.M. Close-up views of "SPIN-PIN" illustrate fast assembly of tailored-lead wire to terminal.

* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. S 6P

BRUNO-NEW YORK INDUSTRIES CORPORATION

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panies were present: Compagnie des Compteurs, Compagnie Francaise Thomson-Houston, General Electric International, International Automatic Electric, International Telephone and Telegraph, Laboratoire Central de Telecommunications, La Radio Industrie, Le Materiel Telephonique, Radio-Air de Paris, Sadir-Carpentier, Siemens, Halske (Munich), Sintra, Telecommunications Radioelectriques et Telephoniques (TRT).

Rome (Italy)

A tour of the Italian RAI television facilities in Rome was featured at the March meeting. The studios and transmitter site atop Monte Mario were both visited. Chief Engineer Cuturi demonstrated a variety of American, British, Italian and German equipment.

On May 19th, the chapter visited the development laboratories of Instituto della Poste e Telecommunicazione. The tour was conducted by Professor Renato Manfrino, Chief of the Transistor Application Laboratory. Studies on transistor research, UHF and microwave research, acoustic research, and electron microscopy were observed.

San Francisco

The Military Sea Transport Service, under the auspices of Adm. H. S. Persons, Commander, Pacific Area, was host to the chapter on May 18th.

The program was planned around a tour through the transport *General Hugh Gaffey* which was docked at Fort Mason. Capt. R. C. Klinder, director of the cargo division, gave the group a very interesting and informative talk on MSTS operations. Lt. David Gochenour, aide to Admiral Persons, assisted by six ship's officers, took the group through a most instructive tour of the ship.

The evening ended with coffee and dessert served in the ship's dining room.

London Chapter changes command: Capt. Edward F. Metzger, USN, newly elected president, accepts the chapter's charter from Brig. Gen. S. M. Thomas, USAR, retiring president, at the May 29th meeting.

San Juan

At is annual meeting at Fort Brooke on May 24th, the chapter elected the following officers and directors for 1956-57:

President — James P. Fitzwilliams, Antilles Signal Office; 1st vice president — Kinne D. Prachel, radio and television service; 2nd vice president—LCdr. Zacharie T. Hampton, Executive Officer, NavComSta; treasurer—Jose A. Pabon, communications officer, Commonwealth of Puerto Rico Police Dept.; secretary — Albert B. Pulcini, Puerto Rico Telephone Co.

Directors—Felix N. Gros, Civil Aeronautics Administration; Thomas D. Moore, Signal Office, Fort Buchanan; Robert L. Petersen, U. S. Naval Station; Thomas Ramirez, Antilles Signal Office, and Frederick Wilhelm, RCA Communications.

Paris: Shown at the May 28th dinner-meeting are, left to right: Joseph R. Pernice, chapter president; Dr. Maurice Deloraine, president, Laboratoire Centrale De Telecommunication; Capt. Edward C. Callahan, USN, Bureau of Aeronautics, and Mrs. Pernice.

Scott-St. Louis

Maj. Gen. Francis L. Ankenbrandt, USAF, Director, Communications-Electronics, The Joint Chiefs of Staff, was the principal speaker at the May 11th dinner-meeting.

In his talk, the General first gave a brief review of the history of the Association and pointed up the support given it by the Armed Services as a worthwhile organization contributing to the defense effort.

General Ankenbrandt described the duties and functions of his Directorate and of the Joint Communications-Electronics Committee, of which he is Chairman. He also reported on the experiments being conducted relative to "scatter transmission."

"Today's Role of the Army and the Signal Corps" was the subject of an address by Brig. Gen. William P. Pence, Chief, Signal Plans and Operations Division, OCSigO, before the chapter's June 1st meeting.

General Pence reported that the development of the "battle group" marks a new trend in Army battle methods. It is a self-sufficient, fully mobile organization about the size of a present battalion and is capable of moving cross-country by itself. These units travel with large space intervals between them, with reserve forces dropped in by helicopter.

The speaker also described the advanced communications network, known as the "grid" system, developed by the Signal Corps for the new battle groups, and pointed out its extreme flexibility and extensive use of radio in mobile units.

Reports on the national convention in Boston were presented by President Walter Van Skiver, Col. Charles W. Gordon and Secretary Allan Eisenmayer. Howard D. Yund, publicity chairman, had made slides from color

photographs taken at the convention by President Van Skiver, and these were shown in conjunction with the convention report.

Seattle

Diversified programs featured chapter meetings this spring. Among them was a talk and film on Project HIGHJUMP, the 1946-47 Byrd Antarctic Expedition at Little America, Antarctica, presented by Lt. Robert L. Nichols, USN, who was assigned to the expedition as staff airborne electronics officer. Lieutenant Nichols described the expedition in detail and related many interesting experiences, conducting a question and answer period at the conclusion of the program.

At the April meeting, Mr. Rine Foss of the University of Washington Applied Physics Laboratory presented a talk and display on new electronic equipment being developed by the laboratory under contract for the Navy. The principal item of equipment discussed was a recording device used primarily for investigation of the action of devices and objects under water.

• Another speaker from the University of Washington, Ned Brand of the Department of Physiology, addressed the May 9th meeting. Discussing the applications of electronics in physiology research, Mr. Brand stated that work at the present time is mainly concerned with the investigation of electrical impulses generated by body cells. He also described the various instruments and devices which have been developed for these investigations, such as an electrode with a diameter of one-fourth mu for insertion into cells and a 16-channel oscilloscope for study of the heart.

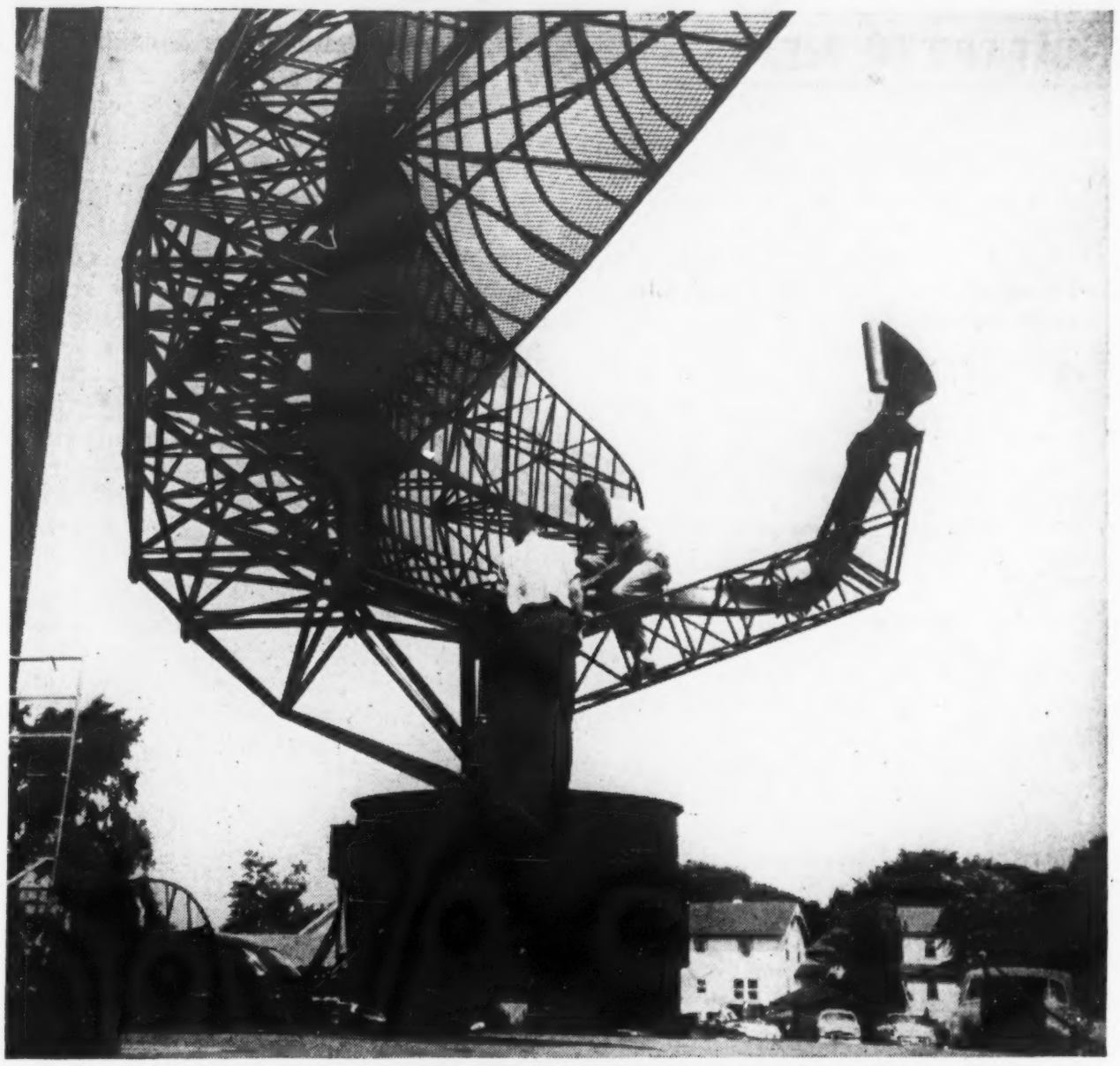
South Texas

The April 25th program featured an outstanding color film, "This Is Your Army," which portrays the Army's role in maintaining the peace and its significance in world affairs today. The global aspects of the Army are also covered in the film, showing the U. S. responsibilities in NATO, Europe, Korea. Panama and Alaska.

The reaction to the previous program of selected films was so favorable that the chapter has decided to run "This Is Your Army" as the first of an intermittent series planned for the ensuing year which will portray the role of each of the three Services in national defense.

The May 16th meeting was held jointly with the local sections of AIEE and IRE. The program was "User Preference Research in Engineering" presented by Robert R. Riesz, Electrical Communications Department, Bell Telephone Laboratories, and consisted of an illustrated discussion of the research studies to meet the growing need for more effective methods of evaluating user acceptance of new systems and devices prior to actual engineering research and development.

Some of the questions considered were: "What services and devices are people going to want ten years from



New 40-foot high-gain search antenna to be used with the AN/TPS-1D Signal Corps radar.

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now?"; "Would people prefer this or that form of a proposed new system?", and "How will the user feel about a given change in quantity of service?"

The dinner-meeting was held at Fort Sam Houston Officers Club, with an attendance of 110.

Southern Connecticut

The Whitney Blake Co., manufacturer of wires and cables with various types of insulations for the electrical and communications industry, was host to the chapter for its March meeting.

The tour of the plant was conducted in such a manner that the visitors were able to see the stock piles of raw materials and the subsequent processing right up to the finished products. The modern equipment—some of it no more than a year old—was seen in use. The continuous vulcanization process was demonstrated and showed the members and guests the most efficient and economical method of insulating wires and cables.

Tinker-Oklahoma City

Loyd G. Dorsett, president of Dorsett Laboratories, was installed as the newly elected president of the chapter at its May 10th meeting.

Other new officers installed were: vice-presidents — Jack W. Grewell, CAA; Delbert F. Cravens, Southwestern Bell Telephone Co.; Col. Lewis G. Young, 33rd Air Division; and W. A. Kitchen, Oklahoma Gas & Electric Co.; secretary—Col. William L. Gregory, 1800 AACS Wing; treasurer—Robert E. Davis, 1st AACS I&M Sqdn.

The following were installed as directors: Col. S. A. Mundell, 1800 AACS Wing; John C. Mercer, 1800 AACS Wing; C. Hubert Nesbitt, Western Union; George M. Dill and Hal H. Doolittle, Southwestern Bell Telephone Co.; Grant K. Landon, Oklahoma City Fire Dept.; Frank J. Rohrer, Western Union; O. E. McClain, Tinker AFB; Maurice M. Williams, Southwestern Bell Telephone Co., and Thomas Stevens.

Principal speaker was William P. Atkinson, nationally known builder, past president of the National Home Builders Association and developer of the Nation's model city, Midwest City, Okla. He is also serving as the chairman of the Oklahoma Committee for the Frontiers of Science, a committee appointed by Governor Gary to develop ways and means of promoting and expanding science and engineering programs in Oklahoma and the greater Southwest.

Mr. Atkinson's topic was "For Peace or War—Science Comes to Oklahoma."

During the business session, plans were discussed for chapter-sponsored scholarships for high school students majoring in electronics.

Tokyo

The Air Force was host for the May 4th general meeting of the Tokyo Chapter. Held at the Rocker Four Club, the program included a luncheon, a business meeting, election of officers, a guest speaker and several tours of Japanese camera companies.

Brig. Gen. Donald L. Hardy, MAAG-J, delivered the principal address and brought out the importance of Japanese and American business relations. Among the 180 members and guests in attendance were Japanese officials of the Nikkon and Konica Camera companies which were visited by the group at the conclusion of the meeting.

New officers were elected as follows: president — James T. Ramsey, Philco Corp.; 1st vice president—Col. Stuart S. Hoff, AFFE/8th Army; 2nd vice president—Capt. Robert H. Weeks, COMNAVFE; 3rd vice president—Lt. Col. Michael E. Wardell, MAAG-J; secretary — Robert M. Fleisher, RCA; treasurer — Maj. John A. O'Connor, 1808th AACS Wing.

San Francisco Chapter members were guests of the Military Sea Transport Service on May 18th. Left to right: Capt. Roy C. Klinder, director of the cargo division; Chapter President C. L. Wickstrom; Col. Lloyd C. Parsons, AFCEA Regional Vice President, and Lt. David Gochenour, aide to Admiral Persons, Commander, Pacific Area, MSTS.

New directors: Brig. Gen. Harold G. Hayes, AFFE/8th Army; Capt. Robert H. Weeks, COMNAVFE; Col. Charles J. Harrison, Hq. FEAF; Col. Thew J. Ice, Jr., FEC J-3; Cmdr. Ellis Schiller, NAVRADFAC (Kamiseya); Lt. Col. Bill Buerkle, 1st Cavalry; Frank E. Colonna, RCA; Maj. Harry H. Stratford, Jr., Hq. AMFPA, and Maj. M. H. Jones, Signal Overseas Comm. Bn., Camp Drake.

Washington

Dr. John P. Hagen, director of Project VANGUARD, set up to build and launch America's first space satellite during the International Geophysical Year 1957-58, was guest speaker at the chapter's May 3rd luncheon-meeting at the Willard Hotel.

Discussing "Exploration of Outer Space with an Earth Satellite," Doctor Hagen told the audience of 350 members and guests that the satellite probably will circle the earth for two weeks. He detailed some of the planning and stated the satellite program is on schedule and will meet its deadlines. He mentioned no specific launching date, but it is planned for sometime between July 1957 and December 1958.

An article on this subject by Dr. Hagen and Mr. Charles Devore will appear in the September-October issue.

During the business session, new officers were elected, with Millard C. Richmond of Western Electric Co. chosen to head the chapter during 1956-57.

The other new officers are: vice presidents — Col. B. M. Wootton, USAF; Brig. Gen. W. P. Corderman, USA; Capt. Gordon L. Caswell, USN, and L. Harriss Robinson, Motorola, Inc.; member, executive committee—John F. Gilbarte, retiring president; secretary—George Sheets, Stromberg-Carlson Co.; treasurer—Harry M. Stephey, Philco Corp.; general counsel—Capt. Franz O. Willenbucher, USN (Ret.).

Board of Directors: RAdm. Rawson Bennett, USN; Percy G. Black; John N. Boland; J. M. Bridges; Capt. W. I. Bull, USN; Francis Colt deWolf; Col. J. A. Gerath, USMC; Capt. G. Van A. Graves, USCG; Ralph Irwin; Thomas B. Jacocks; Col. W. W. Lindsay, USA; Col. J. R. McNitt, USAF; James B. Morrison, and E. H. Pierce.

"Interesting Applications of Nuclear Energy" was the subject of the June 8th meeting, with RAdm. Lawrence B. Richardson, USN (Ret.), Senior Vice President, General Dynamics Corporaton, delivering the principal address.

The chapter also heard a brief report from new National President Percy G. Black outlining plans for the further growth and expansion of the Association. Colonel Black was president of the Washington Chapter in 1951-52.

The newly elected officers of the

LINCOLN LABORATORY

50kw UHF SCATTER

INSTALLATION USES

EIMAC KLYSTRONS

Lincoln Laboratory uses Eimac klystrons again in its 50kw experimental tropospheric scatter installation at Round Hill. As a pioneer in this revolutionary new communication concept, Lincoln Laboratory, of the Massachusetts Institute of Technology, has been instrumental in developments leading to reliable military and commercial scatter networks.

Engineers responsible for advancing the art of tropospheric scatter set forth exacting requirements. Eimac klystrons have met these requirements through each stage of the evolution of high power.

Fourth in a series on the extensive scatter application of Eimac klystrons.

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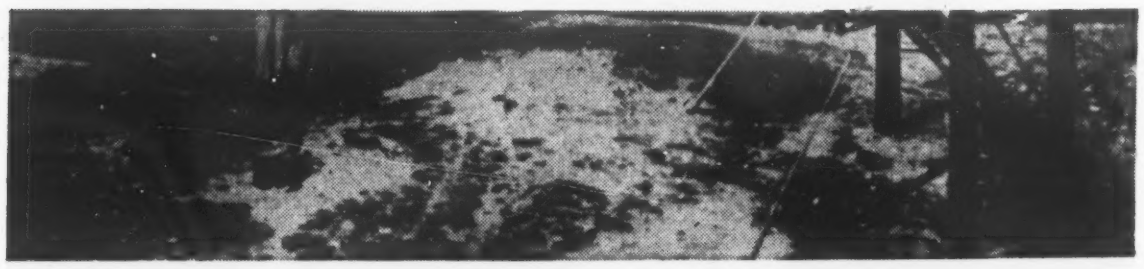


chapter were introduced to the gathering by retiring President John J. Gilbarte who also presented the outgoing officers with an expression of appreciation for their hard work and support during the past year.

Student Chapters

Iowa State College

Several chapter officers were honored at the annual Army ROTC Awards Day on May 21st. Cadet Colonel Roger H. Johnson, president of the chapter and commander of the Cadet Corps, won the Sojourner Award, and Cadet Major Edmund F. Abodeely, vice president of the chapter and executive officer of the Signal Corps Cadet Battalion, was awarded the Chicago Tribune Silver Medal.

Northeastern University

The following report was received from the chapter recently:

"Recent activity in the largest student chapter has been keynoted to one theme—preparation by the members to serve during the national convention as registration clerks, aides, and in other capacities for which need might arise. Numerous extra meetings were necessary to make sure of adequate ground work.

"Having been assured that the national membership would be interested, the chapter also went to work on a motion picture to portray the lives and times of AFCEA student members and on a display of electronic equipment for a room at the Statler Hotel made available to them by the Association.

"One big convention event, which this chapter preempts as its personal news, was the presentation of medals to four outstanding Northeastern University ROTC cadets during the annual banquet by Maj. Gen. James D. O'Connell, Chief Signal Officer of the Army. The medals were honors enough, but

Washington: Dr. John P. Hagen, Director of Project Vanguard, who addressed the May meeting on "Exploration of Outer Space with an Earth Satellite."

the dramatic circumstances under which they were actually pinned to the blouses made them shine with even more luster. Col. Murray D. Harris, Professor of Military Science and Tactics at Northeastern, introduced the cadets to General O'Connell and spoke briefly about their achievements in campus, academic and student activities.

"The individuals receiving the awards were: Cadet Major Raynor W. Taylor, AFCEA Gold Medal; Cadet First Lieutenant John S. Tuck, AFCEA Silver Medal; Cadet Sergeant First Class Paul Donato, AFCEA Bronze Medal, and Cadet Colonel Frederic T. Hersey, who received the United States Veteran Signal Corps Association Medal. Martin W. Essigman, Professor of Electrical Engineering and Chairman and Coordinator of Electronics Research at Northeastern, represented the University at the banquet.

"General O'Connell also found time to visit the chapter's display room in the Statler, bringing with him Maj Gen. Gordon A. Blake, Director of Communications-Electronics, USAF. The Generals were shown the motion picture depicting Northeastern's AFCEA student activities, in which they took a gratifying interest. The members were thoroughly impressed by a brief talk of General O'Connell's in which he showed his interest in their training in weapons and marksmanship. Since many of the students had just recently laid siege to the M1 targets at Fort Devens, Mass., with fair success, a reassuring report could be made to the General on this issue.

"Everyone who saw the chapter's moton picture, entitled 'AFCEA Calling,' with synchronized sound tape and a $35.00 budget, paid compliments. While the production staff acknowledges its amateur status and feels that its creation should receive no more credit than is due an amateur effort, the fact remains that this is the finest AFCEA motion picture so far produced (it is understood also to be the first one produced).

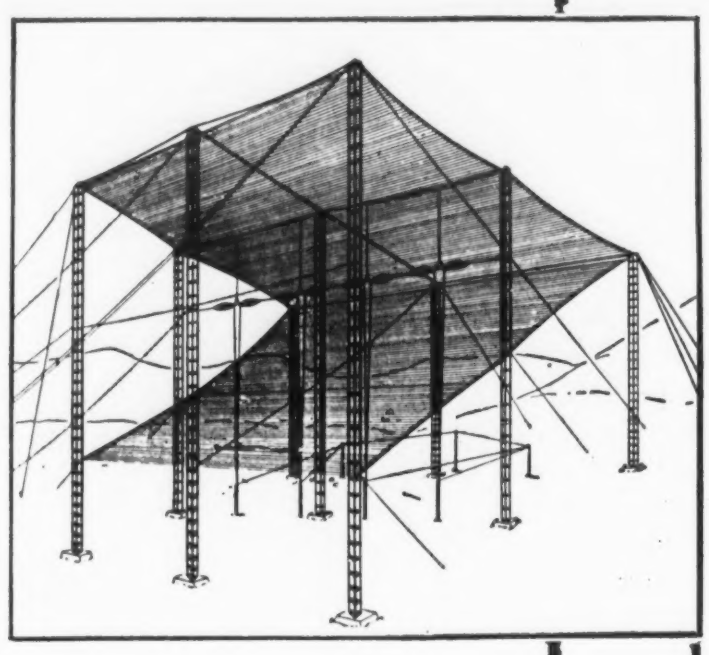
"Friends of 'ham' radio recognized kindred spirits around K1WAS (portable at the time) in the chapter's room at the Statler. No significant DXing took place during the convention. but Saturday, just before striking camp, Guantanamo, Cuba, came in with a nice strong signal.

"The chapter was overwhelmed to a man by the interest displayed in them as individuals by the group members and others who attended the convention. Everyone learned a lot and enjoyed the opportunity to meet and mingle with the alert executives, service and civilian, upon whose industry so much of our national defense potential depends today."

Scott-St. Louis: Maj. Gen. F. L. Ankenbrandt, Director, Communications-Electronics, The Joint Chiefs of Staff, addressed the May 11th meeting. Seated, left to right, are: J. R. Petersen, general manager, Southwestern Bell Telephone Co.; General Ankenbrandt; Chapter President Walter Van Skiver; Col. C. W. Gordon, new commander of Scott AFB TTG. Standing, left to right: Prosper Kinsella, treasurer; Allan Eisenmayer, secretary; E. J. Weber, vice president; RAdm R. E. Melling, USN(ret.); Henry Cooper, AT&T Co.

ONE IF BY LAND... TWO IF BY SEA...

38* IF BY AIR!



TOWER'S DEW LINE INSTALLATIONS GUARD US AROUND THE CLOCK

Paul Revere had a snap when it came to warning the countryside of impending attack. A fleet-footed horse, a feeble lantern or two, and a sharp eye cocked seaward were all that he needed to alert an infant nation's defenses. Today, danger moves swiftly on lightning wings, from any direction. Our security is measured not with an hour glass . . . but with a stop watch!

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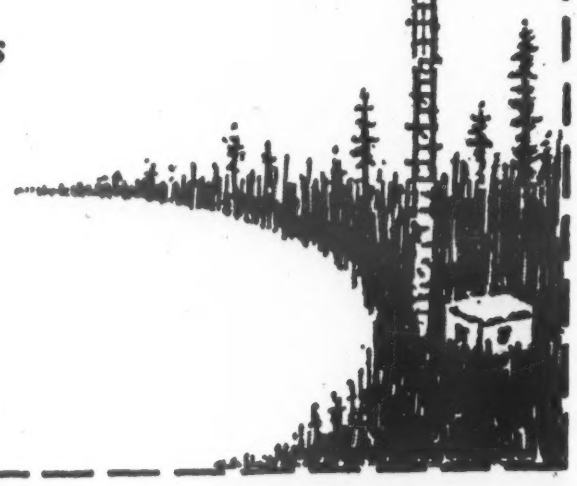


**fictitious figure . . . actual number is classified information*

ITEMS OF INTEREST

From Government, Industry and the Services

Operation "White Alice" Underway

"White Alice," the Alaskan Intergrated Communication Exchange network, is under construction to fill the communication needs of the United States Government and of commercial enterprises in Alaska.

A 289,000 dollar contract has been awarded by the Air Force to Federal Electric Corporation, Lodi, N.J., a subsidiary of International Telephone and Telegraph Company, to operate and maintain this far flung network.

When completed, "White Alice" will consist of a group of over-the-horizon radio stations and line-of-sight microwave radio relay links plus the necessary terminal telephone and telegraph equipment. The network will complement and be linked with existing communication services, interconnecting isolated cities and defense installations.

Shown above are members of the 1956 class at West Point who have entered the Signal Corps. Rear row, left to right: Griffith McRee, Angelo Bortolutti, Roger Root, Robert Goodwyn, Thomas Miller, David Corderman, Richard Johnston, Charles Russell. Middle row, left to right: James Straub, Edward Kime, Edward Daly, Gerald Thompson, Carl Herrmann, Farrell Patrick, James Lane, Martin Zimmerman, Everette Caldwell. Front row, left to right: Richard Chase, Frank Sharer, Mark Binstein, Robert Goodman, Frederick Holmes, George Wien, Silvio Pelosi, Julian Abell.

RCA Shows New Defense Products

Three vital developments in the field of military electronics were demonstrated by the Radio Corporation of America at dedication ceremonies marking the enlargement of RCA's Moorestown, N.J., Engineering Plant for missile and surface electronic systems.

In a dramatic exhibition a portable electronic detector for "nerve" gas developed by the Army Chemical Corps and RCA was put to test on the plant's grounds. A soldier wearing protective clothing carried the detector into a cloud of harmless red smoke which had been discharged by grenades. Instantly, the smoke enveloped the detector, and the unit triggered a built-in audible alarm and a red warning light on its case.

The first such detector accepted for military use, the unit not only can serve as a field alarm for military personnel and installations, but also can be utilized for gas detection of population and industrial centers.

A wide-spaced television image orthicon tube, a standard television camera pickup tube with innovations that increase its sensitivity from five to ten times, was also placed on display. A television camera with a wide-spaced image orthicon tube was focused on a model seated in a lighted room. The camera was turned on and the room lights switched off, rendering the model virtually invisible to the spectators. The image-orthicon tube, however, projected a bright clear image of the model to a television receiver in the room.

Designed to provide television pictures with good resolution and clarity under low light conditions, the wide-spaced image orthicon tube televised objects under light conditions as low as those of a cloudy, moonlit night.

A third major demonstration centered about noise-cancelling microphones and headsets, essential elements of a high-intelligibility interphone system for airborne intercommunication.

This demonstration featured hand-free microphones, a combination headset with an adjustable boom microphone which can be fixed directly in front of the lips.

The microphones are pressure-gradient moving-coil types designed to discriminate between sounds originating from distant and immediate sources. The discrimination is accomplished, in part, by exposing both sides of the microphone diaphragm to the sound field. Sound from the lips applies greater pressure to one side of the diaphragm than sound from a distant source, such as ambient in-plane noise, and the microphone responds to the difference in pressure.

Electronic Brain Orders Supplies

An electronic brain, International Business Machine's 702 Electronic Data Processing Machine, does a man-sized job of providing the thousands of Naval aircraft based around the globe with parts and equipment they need.

Installed at the Navy's Aviation Supply Office in Philadelphia, Pa., it handles one of the largest inventory control problems ever to be turned over to an electronic computer. It keeps track of approximately 450,000 different items, stocked in more than 60 separate shore-based locations.

The Navy's "Program Usage Replenishment System," a wide spread information gathering system, has as its hub the "702." From each of the stocking points to be supplied comes an up-to-date report of what is on hand.

The "702" digests all of this incoming data and determines what each base will need for the next nine months. Thus the man in the field no longer has to guess or compute what he needs.

He simply reports what he has on hand to Philadelphia. An answer comes back telling him what he will receive to meet his demands, where it will come from, and what he should ship to other locations so he can get

(*Continued on page* 82)

IN THE PALM OF HIS HAND

. . . a complete military transmitting and receiving station weighing about one pound!

The "battle maneuvers" illustrated above disclose a new dimension in military communication, made possible by modern transistor developments.

In his hand the officer holds an RCA Transceiver, a complete radio transmitting and receiving unit—the smallest 2-way FM radio ever built. The entire walkie-talkie is only 6″ x 3″ x 1⅛″ in size, with weight, including battery and all accessories, of about 20 ounces.

The men in the field listen to "battle instructions" over tiny receiver units built inside their helmets.

With a range of about a quarter mile, the RCA Transceiver can be pre-set for any frequency between 45 and 52 mcs. Only two controls are used and no tuning or adjustment is necessary during normal use. The receiver is an all-transistorized superheterodyne and the transmitter comprises two transistors and one tube, both contained in a single unit.

The feather-lightness and miniature size of the transceiver and receiver make it possible, for the first time, to extend communication to the individual level. It is another instance of RCA's constant search for new and better ways of doing things electronically. Demonstration and consultation with RCA field engineers throughout the world are invited. Call or write.

RCA Ultra-Miniature FM Transceiver compared with AN/PRC-10 (Walkie-Talkie)

TYPICAL MILITARY APPLICATIONS

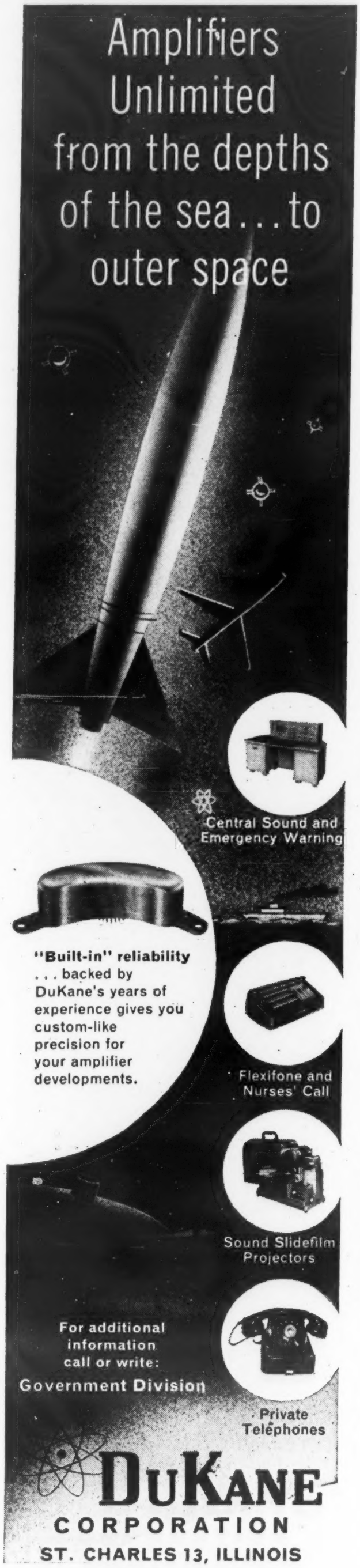
- Tactical communications between squad and platoon leaders and higher, also with individual soldier or marine
- Military police and sentry duty
- Air and sea rescue (unit in survival kits)
- Guided missile installations (before and after take-off)
- Communications between maintenance crews, fire crews and between crew and control tower.

Medical work (litter bearers to field hospitals) . . . *and hundreds of others.*

DEFENSE ELECTRONIC PRODUCTS

RADIO CORPORATION of AMERICA

CAMDEN, N. J.


Amplifiers Unlimited from the depths of the sea... to outer space
Central Sound and Emergency Warning
"Built-in" reliability ... backed by DuKane's years of experience gives you custom-like precision for your amplifier developments.
Flexifone and Nurses' Call
Sound Slidefilm Projectors
For additional information call or write:
Government Division
Private Telephones
DuKane
CORPORATION
ST. CHARLES 13, ILLINOIS

ITEMS OF INTEREST

rid of his overages and help others meet their demands.

The reports to the 63 shore-based operations are not the only output of the electronic brain. It also produces other significant reports such as procurement analyses, reports on retention and disposal quantities, catalogs and schedules.

Avionic Operational Equipment Designed for Air Force

The U. S. Air Force has a new electronic close-support ground guidance radar to operation elements. Called the MSQ-1A, this close support set was designed and built by the Reeves Instrument Corporation, a subsidiary of Dynamics Corporation of America.

Climatized for world-wide operational use and air-transportable, the MSQ-1A system consists of three basic vans — radar, computer and communications.

The radar van tracks friendly aircraft and furnishes continuous data to the computer van for evaluation. The computer van analyzes, interprets, and issues all necessary command instructions for guidance or tactical operations of the aircraft.

In addition, this unit provides a continuous plot of the location of any and all airborne weapons systems. Proper functioning of the system can be checked by using a series of built-in automatic test problems.

One of the earlier MSQ systems was used as a ground radar station during the March, 1955 atomic tests at Frenchman's Flat, Nevada, to precisely position pilotless jet planes for the atomic blast at a pre-determined time and location.

WESCON to Open in Los Angeles

WESCON, the Western Electronic Show and Convention will open in Los Angeles, Calif., on August 21, displaying 706 electronic exhibits.

The second largest electronics trade show in the nation, WESCON

(*Continued on page* 83).

PRODUCTION TECHNIQUES FOR AUTOMATION

The use of "printed wiring" boards for mechanized production is becoming the generally accepted approach to automation in the electronics industry.

One of the requirements of automation, which must be met by builders of machines, arises from the situation of assembling components on printed boards of multiple sizes and shapes. It is apparent that most companies prefer to produce an individualized product which is uniquely distinguishable and representative of their company. This is a natural competitive situation and does not pose a difficult problem on the machinery builder, providing that the machinery user does not demand complete flexibility in the machine to process all sizes and shapes of printed boards.

In the case of the "Mini-Mech" System, however, developed by Melpar, Inc., for the Navy, standardization compels the circuit designer to use components which have been previously determined to be suitable for machine handling and machine assembling. Furthermore, it compels the circuit designer to position the component on the printed board with respect to the standard grid pattern.

When this has been accomplished on the bread board model, it establishes the final design for production manufacture. This operation cannot be overemphasized in terms of savings in cost and time. Elimination of methodizing applies particularly to short-run production.

The soldering operation is a prime consideration in the production of electronic assemblies. Melpar engineers developed a technique for Mini-Mech which provided a means of controlling the time, temperature, and the amount of solder to obtain a reliably soldered connection.

As the component is machine inserted and crimped to a typical printed wiring board, a heated anvil is brought into contact with the bent-over component lead and the printed wiring. By previously electroplating solder to the board, 6 to 8 mils thick, and using an anvil heated to 580°F for a time period of .4 of a second, a reliable connection is secured which does not disturb the value of the component.

The trend is toward building electronic equipment with smaller components, increasing components density and decreasing weight. Very small components, such as resistors and capacitors, are now available for production assembly. As an example of the flexibility offered by their use, the "Mini-Mech" seven-component board can be readily converted to a twenty-four-component board. The trend to reduce the size of electronic equipment is with us, and we must recognize it.

by A. A. Lawson
Melpar, Inc.

ITEMS OF INTEREST

is sponsored jointly by the West Coast Electronics Manufacturers' Association and the San Francisco and Los Angeles sections, representing the Seventh Region, Institute of Radio Engineers.

The Convention, which is held on alternate years in San Francisco and Los Angeles, was originated in 1946 by the two sponsors to promote the electronics industry in the West.

Transceiver Control Station For Air Force Supply

The Air Force's world-wide Transceiver Control Station, a station that will handle supply requests from major air commands all over the world, will be completed this fall in Tulsa, Oklahoma.

Linked to the Far East through a "gateway" station at McClellan Air Force Base, California, and to Europe and North Africa through Andrews Air Force Base, Maryland, the primary mission of this central hub of Air Materiel Command's logistical transceiver network will be to relay overseas requisitions and logistical data to the proper air materiel area.

The central station will also relay shipment status information to overseas consignees and will control transmission of other logistical data.

Through the use of transceivers, punch card machines that record data received via radio, teletype or telephone circuits, requisitions can be flashed from any part of the world in minutes.

NCR Opens Research Center

The National Cash Register Company recently dedicated its new West Coast Electronics Division in Hawthorne, California, in ceremonies attended by nearly 300 business, industrial, civic, and scientific leaders.

52,000 square feet of working space is provided by this new division center. The center's facilities will be devoted entirely to research and design activity in advanced electronic computers and auxiliary equipment capable of performing highly complex data processing work.

National Cash Register's commercial electronic development program has three objects, according to Mr. Stanley C. Allyn, company president. The first is to adapt the conventional cash register to serve as a means of original entry and input devices for computers. The second object is to

(*Continued on page* 84)

Use Your Military Training

The time was never more opportune than now for becoming associated with the field of advanced electronics. Because of military emphasis this is the most rapidly growing and promising sphere of endeavor for the young electrical engineer or physicist.

Hughes-equipped Lockheed F-94C Starfire all-weather interceptor.

Scientific Staff Relations

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City
Los Angeles County
California

E.E. *or* PHYSICS GRADUATES

with experience in

RADAR *or* ELECTRONICS

or those desiring to enter these areas...

Since 1948 Hughes Research and Development Laboratories have been engaged in an expanding program for design, development and manufacture of highly complex radar fire control systems for fighter and interceptor aircraft. This requires Hughes technical advisors in the field to serve companies and military agencies employing the equipment.

As one of these field engineers *you will become familiar with the entire systems* involved, including the most advanced electronic computers. With this advantage you will be ideally situated to broaden your experience and learning more quickly for future application to advanced electronics activity in either the military or the commercial field.

Positions are available in the continental United States for married and single men under 35 years of age. Overseas assignments are open to single men only.

produce a complete computing system, consisting of the computer plus all necessary input and output devices and other periphery units. The third part of the program is a thorough survey of system needs of various businesses and the practical application of electronics to their accounting problems.

NAVY RESEARCH ROCKET

A high speed rocket, the ASP, Atmosphere Sounding Projectile, has been especially designed by the Navy Bureau of Ships for studies of the upper atmosphere.

The rocket, which contains a system for receiving and recording scientific data for ground transmittal, will be used to gather weather information, study cosmic ray emanations and other geophysical data.

It can be launched from a simple portable rack and may be shot vertically or almost horizontally to achieve range. ASP, developed and built by Horning-Cooper, Inc., Monrovia, Calif., will be used primarily by the U. S. Naval Radiological Defense Laboratory, San Francisco, California, a Bureau of Ships field activity.

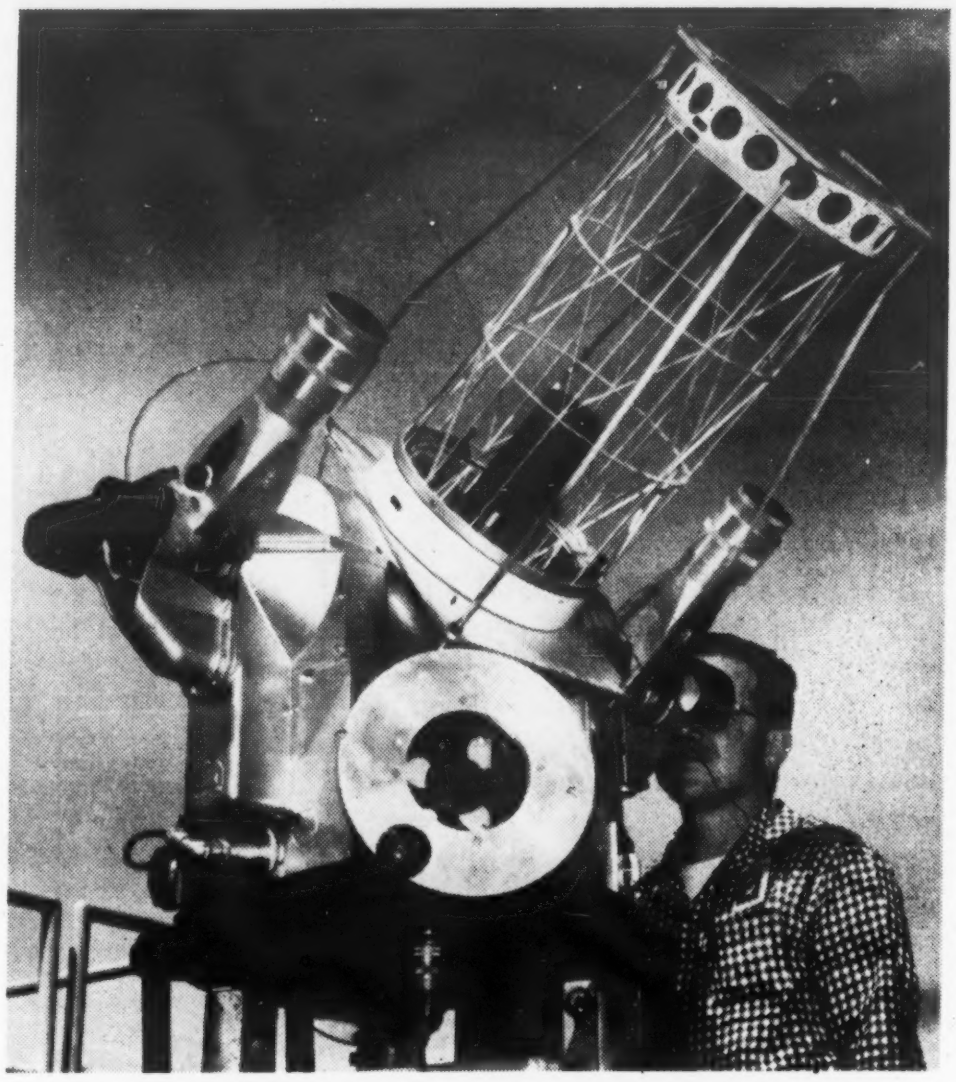
Miniature Control Box Designed For Air Force

A miniaturized radio control box, one-sixth the size of present ones, has been developed by Admiral Corporation for use in U.S. Air Force planes.

The control box will operate various types of 1,750 channel command radio sets in military aircraft. Its compactness, 5½" x 2½" x 2", permits installation where it can be seen by the pilot without taking his eyes off the controls of the aircraft.

The compact control mechanism has seven knobs, each differently shaped so that the pilot can select the desired knobs by touch if necessary.

The first two controls are single knobs. One turns the set on and off; the other pre-sets 20 of the receiver's 1,750 UHF-VHF channels for automatic operation. The remaining five knobs are concentrically arranged (knob within a knob). The latter regulate volume, sensitivity, and permit manual selection of any of the remaining 1,730 channels.



This tracking camera is one of several optical instruments developed by Sandia Corporation, Albuquerque, New Mexico, to record on film the behavior of a free-falling missile in test drops of dummy bombs at Salton Sea Test Base, California. The "bird cage" device on the camera permits adjustment of the effective focal length of the lens over a wide range.

Expansible Van for Army Photomapping

A truck-mounted van which can be expanded to almost twice its seven-foot travelling width has been developed by the Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Va., to provide the Army with mobile units for photomapping operations.

Mounted on a standard 2½-ton truck chassis, the van can be expanded to 13½ feet by two men in less than five minutes to provide a working area of 230 square feet. If the unit must be moved to a more strategic site, the sides can be retracted in the same amount of time.

A photomapping company of an Army Topographic Battalion will be furnished with a "train" of eleven of these expansible vans.

They will provide facilities for computing, plotting, editing and printing aerial photographs; mosaic and multiplex compilation, and supply operation. Each will be heated and air-conditioned for operation in a variety of climatic conditions.

Because of its unique construction features, this van may be suitable for use as radio, radar, and fire control centers.

STRATOSPHERIC TV

An airborne television system which may be used in jet aircraft reconnaissance by the U.S. Air Force has been developed by Philco Corporation's Government and Industrial Division for the Aerial Reconnaissance Laboratory at Wright Air Development Center.

The new airborne television system will provide ground control points with an active picture of troop movements or terrain. It will now be possible to transmit a television picture, not only from near ground level, but from the stratosphere, beyond reach of antiaircraft gun fire. The scope of such a reconnaissance system is almost unlimited.

To cover a wide area, two unmanned television cameras are used in the plane. Signals from the plane are transmitted to the ground control point where they are picked up by a receiver. There, the picture may be instantaneously photographed on 35mm film which can be processed in less than a minute. The picture then can be projected on theater-size screens at the control point, or relayed to other locations.

(*Continued on page* 86)

E. H. RIETZKE, President, CREI
Capitol Radio Engineering Institute

• *One of a series of institutional messages.*

THE PRIVILEGES OF LEADERSHIP

WE HAVE all heard about the "Penalties of Leadership." At CREI we look at it another way. We like to emphasize the *PRIVILEGES* OF LEADERSHIP. The privilege of being among the leaders in technical institute education offers us the finest challege any institution can face—the constant challenge to do *our* best to make our *best* even better.

On June 1, 1956 CREI started its 30th year as an educational institution. Twenty-nine years earlier CREI had been organized with an idea, an ideal, $250 in tangible assets, a very small part of its courses actually in print, and no student body.

The idea has developed at a constantly accelerating pace. We have never deviated from the ideal of providing the *very best* in technical electronic education for *professional* electronics personnel, regardless of cost and effort. We have operated on sound business principles and have plowed the major portion of earnings back into the operation, so that today the tangible assets, including the CREI buildings recently appraised at more than $300,000, are now in the seven figure bracket. The active student body today numbers more than 10,000 professional electronics engineers and technicians, all over the world and in every phase of electronics, both military and civilian.

Over the years CREI has pioneered (or helped pioneer) several important firsts in technical institute education—

a. 1927. The first *advanced* course in Practical Radio Engineering. The scope of this course, previously available only to high rated naval personnel, has constantly expanded with the technical developments and growth of the electronics industry.

b. AUGUST, 1941. The first private pilot course for radio mechanics for the U. S. Army Signal Corps. During World War II CREI in its residence school, trained approximately 5,000 radio technicians for the U. S. Army and the U. S. Coast Guard.

c. 1943. CREI supplied more than 300,000 texts to the U. S. Navy in a special course for radio technicians in the South Pacific.

d. DURING WORLD WAR II CREI was the first private school of less than four year degree level to participate in the ESMWT program of the U. S. Office of Education. Operating under contract with the University of Maryland, CREI trained 3,000 men and women for war industry.

e. 1943. CREI was a founder-member of the National Council of Technical Schools, the organization which first established scholastic and business standards for that essential area of technical education. Mr. Rietzke was the first President of that organization, serving four terms in that capacity.

f. 1944. CREI offered the first large scale program of individual-progress residence instruction ever offered by any institution of higher learning. Now, twelve years later, we consider this to be one of the most important and successful contributions we have ever made in this area of technical education.

g. 1945. CREI was one of the first three Technical Institutes to have its curricula accredited by the Engineers' Council for Professional Development. Mr. E. H. Rietzke, CREI President, served on the original ECPD Technical Institute Sub-Committee and for 10 years represented the private Technical Institutes of the United States on that Committee.

As we enter our 30th year, CREI has in effective operation, group training programs with organizations representing the cream of the electronics industry. Leading companies regularly visit CREI to select graduating students for the better-than-average technical jobs.

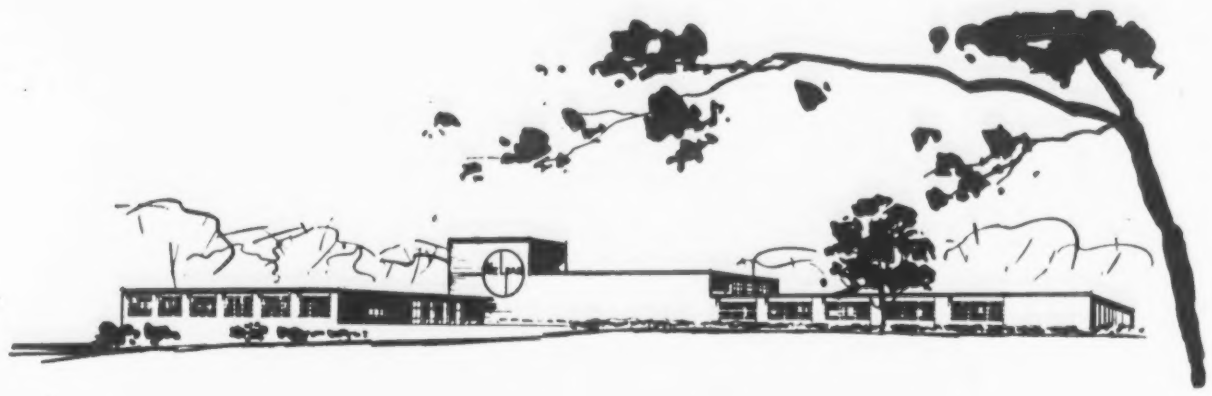
Yes, it is a privilege to be among the leaders in a great and essential field of endeavor. We pledge ourselves to ever increasing effort so that we may continue to warrant the confidence of the great industry which, by the increasing use of our product, has placed a seal of approval on our institution.

CAPITOL RADIO ENGINEERING INSTITUTE

ECPD Accredited Technical Institute Curricula

Dept. 217-C, 3224 Sixteenth St., N.W., Wash. 10, D.C.

ENGINEERS,
Electronic & Mechanical
PHYSICISTS:



Top Grade Openings At Melpar *Leader in Electronic Research & Development*

Due to our continuing expansion program, a number of top grade openings exist in our new laboratories suburban to Washington, D.C. We urge you to consider the following:

1. At Melpar the engineer is not tied to a pre-arranged schedule of advancement. Instead, promotion and advancement are based on *individual recognition,* where skill and ability are the paramount factors of determination.

2. Melpar has doubled in size every 18 months for the past 10 years. New openings occur constantly. This enables the engineer to advance to positions of increased responsibility *as soon as he is ready.*

3. Our unique "project team" basis of organization gives the engineer an opportunity to participate in *entire* problems from conception to completion of prototype, and thus experience the "over-all" approach to engineering problems necessary to eventual directorship responsibility.

4. Our new air-conditioned laboratories encompass over 285,000 square feet and offer *complete* facilities for creative research and design. In addition to our central Model Shop, supplementary facilities, personnel and test equipment are available for *immediate* use within each project group.

5. The Northern Virginia Area, suburban to Washington, D.C., in which Melpar is located, offers excellent living conditions, enjoys the Nation's highest per capita income, fine homes and schools. Recreational, cultural and educational facilities abound. Fully-accredited graduate courses are offered at the Melpar laboratories and at 5 universities in the Area.

Top Grade Openings Exist in These Fields:

Network Theory • Systems Evaluation • Microwave Technique • UHF, VHF, or SHF Receivers • Analog Computers • Magnetic Tape Handling • Digital Computers • Radar and Countermeasures • Packaging Electronic Equipment • Pulse Circuitry • Microwave Filters • Flight Simulators • Servomechanisms • Subminiaturization • Electro-Mechanical Design • Small Mechanisms • Quality Control and Test Engineering.

Write for complete information. Qualified engineers and physicists will be invited to visit Melpar at Company expense.

Write: Technical Personnel Representative

MELPAR *Incorporated*

A Subsidiary of Westinghouse Air Brake Company

3089 Arlington Boulevard, Falls Church, Virginia

Positions also available at our Laboratories in: Cambridge, Mass., 99 First St.; Watertown, Mass., 11 Galen St.

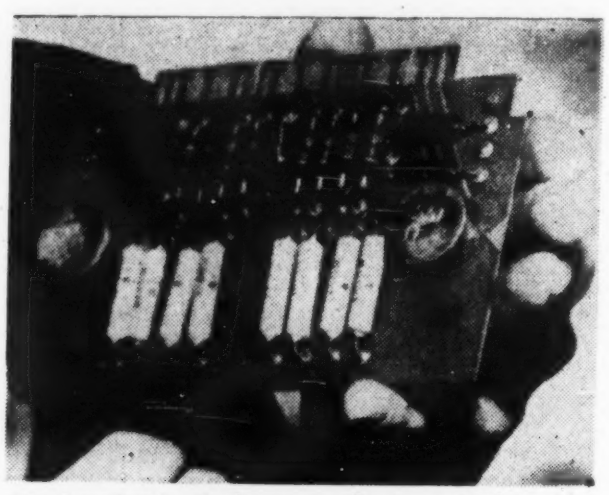
ITEMS OF INTEREST

Remington Rand Computer Designed For Air Force Use

Two revolutionary developments in high-speed, general purpose electronic computer construction were revealed recently in a demonstration of the new, compact Remington Rand Univac AF/CRC Magnetic Computer, designed and built for the Air Force Cambridge Research Center at Laurence G. Hanscom Field, Bedford, Mass.

The new computer will be assigned to classified military projects but its new principles of operation make it highly efficient in the solving of all types of complex mathematical and scientific problems.

As versatile as the giant electronic "brains," it can be housed in about



Six hundred of these cards are used in the Remington Rand Magnetic Computer.

250 square feet. Its computer unit is only 6 feet high, 6½ feet long, and 1½ feet deep. Its desk-sized console, housing the operator controls, the paper tape, input-output unit and the direct entry typewriter, is only 4½ feet high, 6 feet long and 3 feet deep.

The Univac Magnetic Computer employs tiny pulse-amplifying devices known as Ferractors in its internal magnetic-core circuitry and a five-by-three inch magnetic drum, spun at 16,500 rpm, to accomplish this remarkable reduction in size without sacrifice of speed or capacity.

Two Ferractors, each replacing an old-style vacuum tube, are sealed within a casing like a miniature pill box, about ⅝ inch in diameter and a little less than ¼ inch thick. Four "pill boxes" are mounted on thin plastic cards, each about the size of a postcard, along with a number of resistors and a line of midget diodes, tiny electronic fittings.

The cards fit into the front of the computer, set edgewise. Each card, or package, makes contact with many

(*Continued on page* 88)

alfax is revolutionizing graphic recording!

"ELECTRICITY IS THE INK"

IMAGINATION AND BOLD THINKING HAVE PRODUCED A COMPLETE LINE OF GRAPHIC RECORDING EQUIPMENT WHICH ANTICIPATES ALL OF THE PROBLEMS FROM TRAFFIC AND MOTION STUDIES TO HIGH SPEED IDEA TRANSMISSION.

BETTER CONTROL OF PROCESSES AND OPERATIONS

Alfax in Instrumentation

Alfax Paper and Alden Recording Techniques make possible simple fact finders to monitor from 2 to 30 operations simultaneously and for the first time, direct, visual recordings that capture faithfully the full output of electronic detection devices such as infra-red, sonar, magnetic analysis, scanning, etc.

FASTEST— MOST ACCURATE MEANS OF COMMUNICATION

Alfax in Facsimile Transmission

Alfax paper, Alden flat copy scanning, and the Alden adjusterless recording techniques provide new high speed facsimile recording systems that are the most accurate means of communication available today. Scanners transmit any copy at low or high speed to one or several recorders simultaneously in the same building or a thousand miles away.

IMAGINATION AND BOLD THINKING IN DESIGN

Top level men in the Armed Forces and industry who have witnessed the remarkable abilities of equipment made possible by Alfax have envisioned such far-reaching requirements that they have been concerned as to how it is to be made, and how it has been designed, to meet simultaneously the anticipated steep climb of demands in all the various fields where it is needed. The answer is in the—

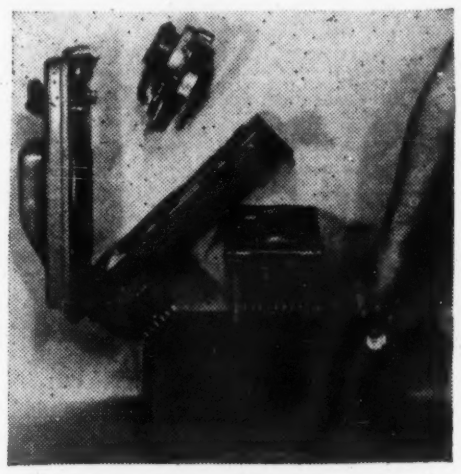
IMAGINATION AND BOLD THINKING AT THE ALDEN RESEARCH CENTER HAVE RESULTED IN:

- ***New Techniques of Simplified Unit Design***
- ***New Techniques of Manufacture and Marketing***

● In anticipation of the tremendous possibilities in direct graphic recording made possible by Alfax Paper, a long range program to develop special, advanced equipment and processes for manufacturing has paralleled the design of Alden recorders and scanners.

Straight line production of Recorders using the Alden Work Center System.

● Because all of the electro-mechanical elements are units and all of the electronic elements are function by function chassis that slide in to connect—all assembly and most machine operations are performed on Alden Work Centers by women operators comfortably seated. Both equipment and product design have been kept under wraps until prototype operation had proved the designs in both areas suited to mass production.



Recorders can be disassembled unit by unit by merely unfastening target screws with a coin.

Individual Electronic Recorder functions slide in or out on easily accessible Alden chassis.

WHAT ARE ALDEN WORK CENTERS?

● Alden Work Centers are prefabricated units themselves. With the methods of each unit assembly worked out, subcontracting, foreign manufacture, or dispersal of production at service centers requires no re-engineering or long training programs to meet peak or emergency requirements.

QUICK SERVICE ANYWHERE IN THE WORLD

● Alden Recording Equipment is simple, compact, and easy to service due to a system of unitized, plug-in construction for both electro-mechanical and electronic components.

● Electro-mechanical elements are divided by function into individual self-contained units. To service or change a function, merely unfasten target screws with a coin and remove unit.

● Electronics are divided function by function with *points of check* for incoming circuits and simple "tell-tale" indicators on any chassis to make it easy to quickly isolate any trouble.

SOMETHING NEW IN SPARES

● Spare units, either chassis or electro-mechanical, instantly replace any element not functioning properly. Spare chassis in padded carrying cases can be airborne—so even half-way around the world a chassis can be replaced in thirty hours. Returned to service center, the inoperative unit parts are easily accessible and understood in the Alden open sided chassis so they are put back in operation with a minimum of delay.

Replacement chassis in padded carrying case ready for air shipment.

● ***The Armed Forces and Industry have grasped the full import of these advances which anticipate and solve many of the problems that are Armed Services objectives in procurement, sub-contracting, quality control, emergency manufacture and dispersal of facilities.***

ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIPMENT CO., Westboro, Mass.

fixed points at the back, actually tiny wires with fitted ends resembling a telephone operator's cord plugs, except that they are less than a half-inch long. Each plug fits into a "jack" just tightly enough to stay put. About six hundred such cards, plus a few ordinary transistors, form the main working portion of the computer along with the high speed magnetic drum.

AUTOMATIC TELETYPE SWITCHING CENTER

Forging a new major link in the Army's global communications system, a fully Automatic Teletypewriter Switching Center has been installed at Davis, California.

The first operational large scale automatic teletypewriter switching center engineered specifically for military traffic, it has 100 lines of fully automatic teletypewriter equipment. It is also the first automatic system using large numbers of long-haul radio channels.

Increased capabilities of the new center will have an immediate bearing on the number of military messages handled by the Army communication system, the Army Command and Administrative Network.

Personnel

GENERALS BLAKE AND PACHYNSKI TO NEW POSITIONS

Maj. Gen. Gordon A. Blake, USAF, former Director of Communications-Electronics, U. S. Air Force, became Assistant Deputy Chief of Staff-operations of the Air Force, effective June 2.

Brig. Gen. A. L. Pachynski, USAF, succeeded General Blake as C-E Director, while Col. Bernard M. Wootton, USAF, the former Chief of Electronics Systems, C-E Directorate, replaced General Pachynski as Deputy Director of C-E.

Because of the diverse nature of his new assignment, General Blake resigned as a national vice-president of AFCEA and as a member of the Executive Committee, positions which he has held since 1954. He will continue as a member of the National Board of Directors.

On his retirement from the Executive Committee, General Blake said,

"I believe the relationship fostered by the Association between its healthy member representation from the industrial world of communications-electronics and the military services, has achieved an understanding and affinity of effort which unquestionably has advanced the common cause of national defense."

General Pachynski has been elected to replace General Blake as 2nd vice-president and as a member of the Executive Committee. As a national officer, he will be an ex-officio member of the Board of Directors.

Key Army Signal Corps depots throughout the Nation and the Army Signal Supply Agency in Philadelphia have been linked by use of an electronic data transmission system forming a network which will speed the reporting of logistical requirements. WAC Pfc. Vivian K. Hudgins is shown working on a transceiver similar to those now located at Sacramento, Calif.; Decatur, Ill.; Lexington, Ky., and Tobyhanna, Pa.

IT&T Names New Executives

Edmund H. Leavey has been elected president of International Telephone and Telegraph Corporation, filling the vacancy caused by the recent death of William H. Harrison.

Elected a vice president of IT&T in 1952, he became president of Federal Telecommunication Laboratories, Nutley, N.J., in 1953. He was elected president of International Standard Electric Corporation, IT&T's overseas subsidiary, in 1954.

Prior to joining the corporation in 1952, he had extensive experience in both the operational and administrative fields of engineering. He was chief of the Logistics Division of Supreme Headquarters of the Allied Powers in Europe (SHAPE) before his retirement from the Army with the rank of Major General in 1952.

Vice Admiral Richard H. Cruzen, USN (Ret.) has been appointed recently as Project Manager for the operation and maintenance of Dew Line, Distant Early Warning Line, by the Federal Electric Corporation, Lodi, N.J., a subsidiary of IT&T.

In his new position, Admiral Cruzen will have full charge of the overall operation of the northern-most of three radar lines constructed for defense purposes.

Change in Command at NRL

Captain S. M. Tucker, USN, turned over his command as Director of the Naval Research Laboratory to Captain P. H. Horn, USN, on May 15th. Captain Tucker is scheduled to retire shortly, completing 30 years of service.

Captain Tucker came to NRL in 1953 as Deputy Director and was made Director in 1955.

Captain Horn reported to NRL from the Bureau of Ships where he was Director of the Ship Technical Division.

Both Captain Tucker and Captain Horn are members of AFCEA.

G-E Reorganization

In a recent reorganization of G-E's Electronics Division, three separate divisions have been formed. They are: Industrial Electronics Division; Electronic Components Division, and Defense Electronics Division.

Dr. W. R. G. Baker, vice-president and general manager of the former division, will continue as a company vice president and, in addition, will be consultant to C. W. La Pierre, executive vice president of G-E's Electronic, Atomic and Defense Systems Group.

Dr. Baker, newly elected president of the Radio-Electronics-Television Manufacturers Association, is a pioneer in the field of electronics. An AFCEA national director, he joined the Association in 1946.

Named general managers of the new divisions are: Harold A. Strickland, Jr., Industrial Electronics Division; L. Berkley Davis, Electronic Components Division, and George L. Haller, Defense Electronics Division.

PERSONNEL CLEARING HOUSE

AFCEA Members Available to Industry

The pages of SIGNAL are open to active AFCEA members who are seeking positions in the communications, electronics and photographic industries. Any member is entitled to space free of charge in this column for three issues of the magazine. Please limit your notice to five lines. In replying, employers are asked to address: Box ....., SIGNAL, 1624 Eye Street, N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

FIELD REPRESENTATIVE OR EXECUTIVE ASSISTANT.. Over 20 years' experience in Defense Agency in top executive assignments, with experience in R & D, procurement and production administration. Working knowledge of R & D and procurement policies and procedures, and equipments. Box 118.

RESEARCH AND DEVELOPMENT ENGINEER—age 30, B.S. in E.E. and B.S. in Bus. Admin. Desires to relocate where part time graduate training in E.E. is available. Prefer communications field (microwave, carrier, telephone, etc.). Further particulars furnished on request. Box 119.

DISTRICT SALES MANAGER OR FIELD REPRESENTATIVE for electronics or associated firm. Excellent contacts with industry and Government agencies in 11 Western states. Fully cognizant of Western industrial expansion. Familiar with all Western Government projects and R&D operations. Capable of setting up Western office, advertising program, marketing, distribution program. Box 120.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

ELECTRONIC ENGINEERS, ELECTRONIC SCIENTISTS, MECHANICAL ENGINEERS, starting salaries $5,335-$6,390. ENGINEERING DRAFTSMEN, $3,415-$4,080. Vacancies now exist at the U. S. Navy Electronics Laboratory, a major West Coast scientific organization engaged in research and development of electronic equipment and systems. For further information address: U. S. Navy Electronics Laboratory, Civilian Personnel Division, San Diego 52, California.

ELECTRONIC ENGINEERS: One Electronic Engineer (telephone) and one Electronic Engineer (radio), starting salary $6,390. Requirements are: degree in electrical engineering and 2½ years professional experience, one year of which must have been in the specialized field, or 6½ years professional electronic engineering experience. Applications should be forwarded to: Hqs., 5001 SU Station Complement, 5th Army, 1660 E. Hyde Park Blvd., Chicago 15, Illinois.

THE SPECIAL DEVICES CENTER, an activity of the Office of Naval Research, located at Sands Point, Port Washington, Long Island, has several vacancies for electronic engineers at $6390 a year, and one vacancy for a general engineer at $6390 a year which requires specialized experience in audio-visual recording. Inquiries should be directed to the Industrial Relations Officer. Telephones: Flushing 7-8300 and Port Washington 7-3800.

ELECTRONIC SPECIALISTS are urgently needed at the Corps of Engineers Research and Development Laboratories, Ft. Belvoir, Va. Applicants must hold a degree in electrical engineering, physics or mathematics, or have considerable research experience in their fields. Salaries range from $4345 to $8940 per year, commensurate with education and experience. Apply to Walter H. Spinks, ERDL, Ft. Belvoir, Va.

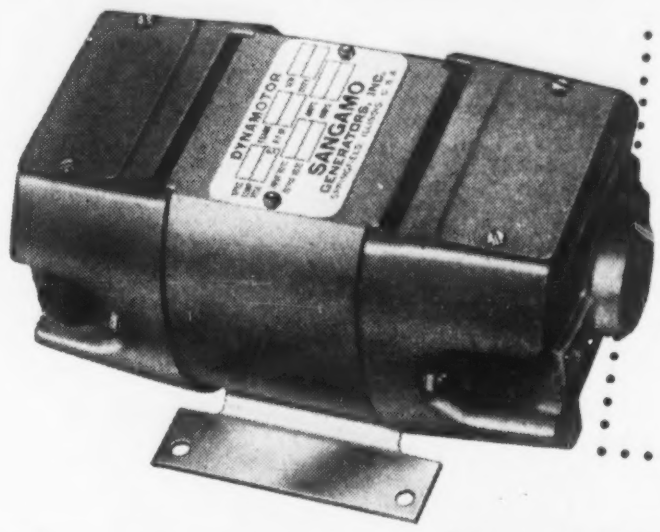
RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

Engineered for Communications Needs

SANGAMO DYNAMOTORS

NEW—for Mobile Radio Use



Small Size
High Efficiency
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High Power Output

the Sangamo "GY" FLATPAK

Now . . . Sangamo research and engineering has developed a new, compact dynamotor of laminated field design that is particularly suitable for mobile radio and general commercial use. Its small size makes it ideal for applications where space is limited. Available in ratings through 110 watts continuous duty and 300 watts intermittent duty. Output to 650 volts.

Here's the Ideal Transmitting Dynamotor

the Sangamo Type SF

This small, rugged dynamotor is ideally adapted to small transmitters. It provides a dependable power supply under the most exacting conditions. Meets MIL-D-24 Specifications for aircraft, marine, and "Hi-Gee" (missile) usage. Wattage ratings up to 75 watts for continuous duty, 200 watts intermittent. Input voltage 6 to 115. Output voltage up to 750.

Bulletin 1530 gives full information on these and other Sangamo Dynamotors—Mail the coupon below.

SG56-2

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ROTARY CONVERTERS • SPECIAL DC MOTORS

NEW PRODUCTS FROM INDUSTRY

Rugged, Compact Klystron

One of the smallest klystrons ever to be built, the new VA-97 reflex klystron is rugged enough to use as the local oscillator tube for airborne radar and similar applications. Manufactured by Varian Associates, 611 Hansen Way, Palo Alto, California, its integral external tuning cavity design has been carried up to a frequency range of 34.0 to 35.6 kMc.

The tiny klystron may be used at any altitude without pressurization and features a slow motion tuner designed to be free from mechanical backlash. Its companion klystron, the VA-94 provided comparable performance characteristics in the frequency range of 16.0 to 17.0 kMc.

Dial-A-Plate Printer

Robertson Photo-Mechanix, Inc., 7440 Lawrence Ave., Chicago 31, Ill., has developed a completely automatic exposure unit called the Dial-A-Plate, which combines in one enclosed printer a quality vacuum printing frame with a new high speed light source. Designed specifically for making pre-sensitized offset plates, the Dial-A-Plate offers speed, compactness and ease of operation.

In operation, it is only necessary to set the dial and the accurate timer control takes over, automatically controlling the exposure. By eliminating undercutting and providing a more even illumination than any other unit, the Dial-A-Plate permits perfect line and half-tone definition.

The printer is equipped with a mercury arc lamp, a scientifically shaped reflector, vacuum blanket, accurate time control, vacuum pump and motor unit, and glass lid and drawer.

The printer comes in two models: a floor model, #2024 for making one 20″ x 24″ plate, or two 10″ x 16″ plates; and a table model, #1016 for making plates up to 10″ x 16″ in size.

Bomac Hydrogen Thyratron

Bomac Laboratories, Inc., Salem Road, Beverly, Mass., announces the development of the BL-257, a new hydrogen thyratron that is electrically similar to an E37A, but ruggedized for vibration and service even under high impact.

Used for mobile and aircraft applications requiring moderately high power, the tube is conservatively rated for 5G vibration from 60 to 500 cps and 3G from 500 to 1200 cps, and also for 60G high impact shock in any direction.

Electrical ratings are 8.0 kv peak anode voltage, 90a peak current and 100 ma maximum anode current. It is rated for ambient temperature range of —50°C to 90°C and for an altitude of 10,000 feet.

Dage "Page Reader"

Development of a TV receiver which retains for any length of time the image transmitted by its Data-Vision closed-circuit telephone TV system has been announced by Dage Television Division, Thompson Products, Inc., Michigan City, Ind.

Called the Dage "Page Reader," it is for use with the firm's Data-Vision TV system announced last December. Data-Vision uses standard telephone lines rather than costly coaxial cables to transmit information.

The new Dage Page Reader employs a special "dark-trace" tube manufactured for Dage by Skiatron Electronics and Television Corp. of New York. Dage has entered into exclusive agreements with Skiatron, under which Dage will have sole use of the Skiatron dark-trace tube for images originated by standard television techniques.

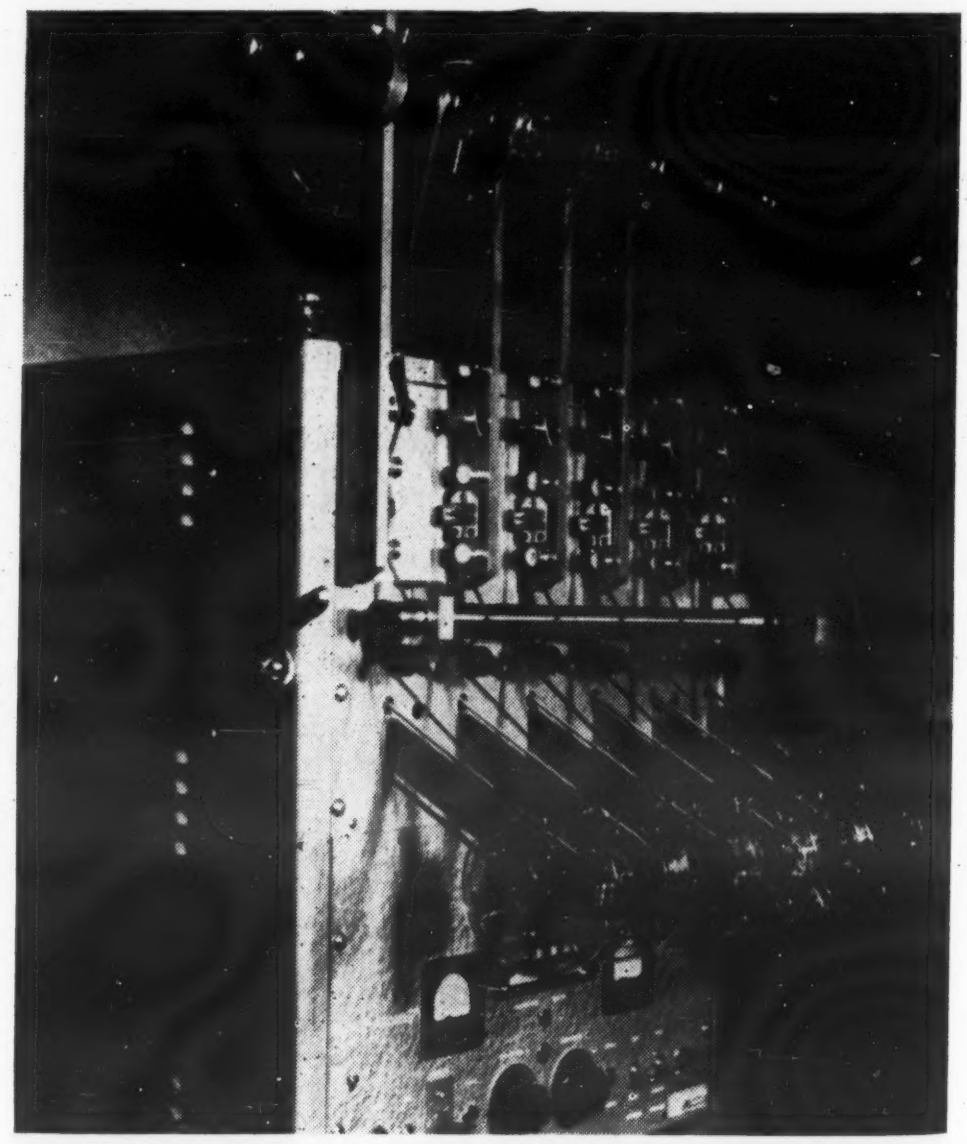
The screen size of the image is 4″ x 5¼″ and the dark-trace tube will retain the image of received data for as long a period as desired. The image, which is dark blue on a white background, may be erased in from 5 to 10 seconds by energizing a heater within the picture tube. The image is viewed in direct light, and just as with any printed material, the more light thrown on the screen, the more visible it becomes.

The Page Reader is intended for situations where a large amount of fine material such as typewritten copy is to be read, or when, although a permanent copy is not needed, it is desired to retain the data for a considerable period for reference.

DuMont Pulse Transformers

A complete line of miniature and sub-miniature pulse transformers offering very fast rise times and exceptionally high duty cycles has been made available by Allen B. DuMont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N.J.

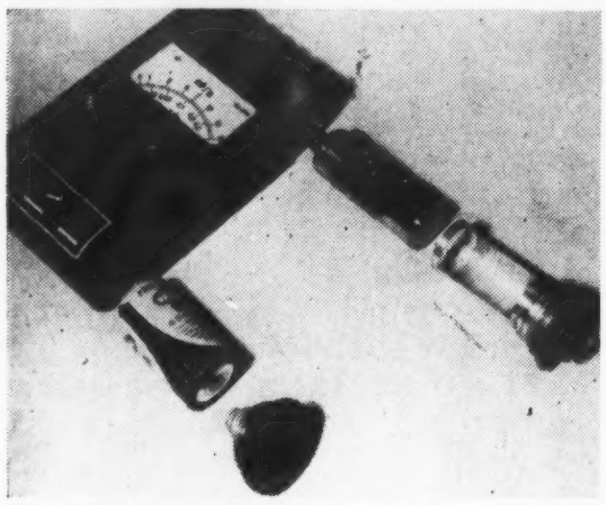
The advanced design of these components will greatly extend the use of pulse transformers in blocking oscillator and coupling circuitry for high-speed digital computers — especially



Pictured at the right is the Multicorder magnetic tape duplicator developed by Benz Aud-O-Scope Corp. of Ann Arbor, Mich. This device makes possible the rapid duplication of professional quality magnetic tapes. It will duplicate full track, dual track, or stereo tapes at the rate of 15 inches or 30 inches per second, and will make five copies from the master tape simultaneously. Frequency response is ±2 db from 50 to 15,000 cps.

airborne types where light weight and high speed operation are an absolute necessity.

The transformers are either molded in epoxy resin, wound in a ferrite potcore, or encased in an aluminum can, and are constructed either as encapsulated or plug-in types. Varied core materials and winding methods make possible a wide range of electrical characteristics.



The lightweight Radiameter, shown with batteries, developed by Curtiss-Wright to detect atomic radiation.

Radiameter Measures Radiation

A new lightweight instrument, designed to detect and measure potentially hazardous atomic radiation in industry or X-rays in medicine is now offered by the Electronics Division of the Curtiss-Wright Corp., Carlstadt, N.J. Called the Radiameter, the unit weighs only two pounds, fits into a suit coat pocket, and operates on an ordinary flashlight battery.

Designed to fit the requirements of the health physicist, this instrument will allow periodical monitoring of installations and X-ray machines, assuring the safety of personnel. It will require minimum supervision from the health physicist.

Supervisory Control Equipment

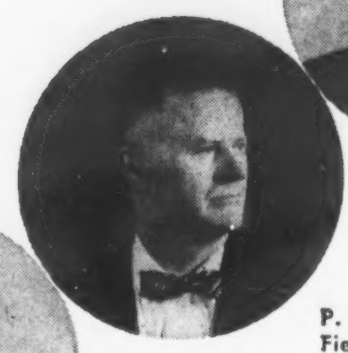
A new supervisory control system, called Type DOS-3, has been developed by Motorola Communications and Electronics, Inc., 4501 West Augusta Blvd., Chicago 51, Illinois. With this type equipment, available in two ultimate capacities, 25 and 50 points, one operator can supervise many electrically operated devices.

The new system was designed to provide reliable, economical and compact centralized control for petroleum pipeline pumping stations, off-shore petroleum gathering installations, electric power stations and railway systems, and to permit the serving of many remote stations.

Featured are "building block"

(*Continued on page* 92)

W. W. Crissinger
Chief Field Engineer
Galion, Ohio



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Field Engineer
Northeast

John Billis
Field Engineer
Mideast

Uriah L. Allen, Jr.
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Washington, D. C.

Ned B. Earley
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packaging to allow custom design and system flexibility, automatic alarming and memory circuit, and fast selection and operation. A special optional feature is the increment control that permits degrees of "open," rather than the conventional two-position "open-close" control.

Prodelin Parabolic Antenna

Production of a 28-foot parabolic antenna for tropospheric scatter transmission has been announced by Prodelin, Inc., Kearny, New Jersey.

Antenna feeds have been designed for use in the 450 to 2,700 megacycle range. Verified manufacturer's pattern and gain measurements are available for the large parabolic antenna. Quality control tests are made on these antennas with Prodelin's scatter site turntable facilities.

Utilizing an aluminum mesh reflecting surface and back-up support, a 65-pound wind load rating is provided. The Prodelin parabolic antenna achieves structural stability through the use of tower "K" frame construction using all aluminum members.

Detailed specifications and performance data may be obtained by writing the manufacturer, Prodelin, Inc., 307 Bergen Avenue, Kearny, New Jersey.

Tiny Power Supply

A new concept of portable power and instrumentation is exemplified by the compact electronic transistorized DC to DC power supply that produces 16,000 volts from as little as 3 volts input and yet fits in your hand.

One of more than 50,000 transistorized power supply units manufactured by Universal Atomic Corporation, 19 East 48th Street, New York, 17, N.Y., this power supply unit measures only 1½" x 3" x 6".

UAC power supplies are now being used by Government and commercial firms throughout the country for cathode ray tubes, photomultiplier tubes, infrared applications, radiation detection instruments and wherever portable power is required.

Amperex Transistor

A new switching-type transistor, designated as type OC76, has been developed by the Amperex Electronic Corporation for DC converter applications.

Some of the uses of the new OC76 as a DC converter will be in the high voltage supplies of portable and mobile radio sets, in transistorized photo-flash units, and in Geiger counters.

The OC76 offers the advantage of a 250 ma peak current capability in a small package. Its collector-to-base voltage rating is 32 volts.

Further data on the OC76, as well as applications engineering information, may be obtained from the Semiconductor and Special-Purpose Tube Department, Amperex Electronic Corp., 230 Duffy Avenue, Hicksville, L.I., New York.

Rugged, Light-Weight Triodes

Machlett Laboratories, Inc., Springdale, Conn., announces the ML-6696 and ML-6697 coaxial terminal triodes, employing thoriated-tungsten filaments, for industrial r-f heating and for broadcast equipments of 50-60kW power output. These new triodes provide excellent performance ratings, high safety margins and great mechanical strength.

The ML-6696 is particularly suitable for water-cooled industrial heating equipments, either dielectric or induction, while the ML-6697, forced air-cooled, is ideal for high power dielectric heaters and for AM broadcasting.

Optical Filter Traps Light

Polaroid Corporation, 730 Main Street, Cambridge, Mass., has developed a new light filter that traps between 98 and 99 percent of all reflections from surrounding light on a radarscope, or any cathode ray tube instrument. By removing reflections which tend to wash out the display, it makes the image sharp, and easy to read.

The filter gets its "one-way" properties through circular polarization of the light striking it from outside sources. It can be combined with a linear polarizing filter so the observer can vary the brightness of the display without readjusting the scope.

Silicon Power Rectifiers

A new line of silicon power rectifiers has been developed and is available from the Federal Telephone and Radio Co., 100 Kingsland Road, Clifton, New Jersey. Ideally suited for airborne power supplies and other airborne electronic equipment, they may also be applied wherever minimum size, high operating temperature and resistance to vibration and shock are required.

Electrically, the new rectifiers exhibit exceptionally low forward voltage drop when passing full rated forward current. The negligible leakage current is most appealing to design engineers. Stud-type mounting available per Government specifications assures reliable service under the most adverse conditions.

Powermaster Photocells

Power sufficient to operate a relay at normal daylight levels is provided by a new line of cadmium sulphide photocells. A development of Hupp Electronics Company, Forest Park, Ill., the highly miniaturized unit will control a commercial sensitive relay without amplifications.

Called "Powermaster Photocells," these elements are light sensitive over the entire visible spectrum, with a peak sensitivity to a blue-green color. They have a low noise level and high dark resistance; stability is rated excellent so long as power dissipation rating is not exceeded.

"Powermaster Photocells" are di-

(*Continued on page* 94)

A new optical filter for radarscopes developed by the Polaroid Corp., Cambridge, Mass.

A COMPLETE hf COMMUNICATIONS STATION

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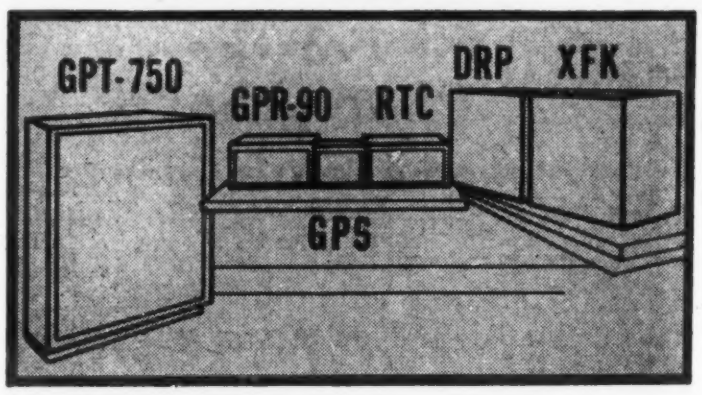
GSB-1 BULLETIN S-194
SBE-1 BULLETIN S-195

You in the services are already familiar with the excellence of the various component equipments manufactured by TMC and its Canadian subsidiary, TMC (Canada) Limited.

Now for the first time, we are highly gratified to be able to offer you a completely integrated, logistically supportable, HF Communication System, with all equipments designed and manufactured under one roof, out of a single family of components, meeting and exceeding JAN/MIL requirements throughout. Many of the equipments shown above are already nomenclatured, stock numbered, and provisioned in your supply depots.

All of our equipment is designed for mobile, air transportable, and transit case packaging as well as fixed station use.



Send for Bulletins

Complete specifications, features and applications are available in separate Bulletins. When requesting Bulletins include all your needs and appropriate Bulletins will be included or you may have the complete catalog of present Bulletins and new Bulletins will be added automatically as issued.

GPT-750 The GPT-750 is a ruggedly designed transmitter for radio telephone, telegraph, frequency shift and facsimile operation over the entire range of 2 to 32 mc. It is conservatively rated at 900 watts output CW or FS and 500 watts output radio telephone, continuous commerical service, with kilowatt output commonly used in intermittent services. The GPT-750 is constructed on a building block basis providing many combinations for all the commonly used services. Its versatility is greatly extended by several accessories and details of these and the transmitter are available in Bulletin S-174.

GPR-90 The GPR-90 is a 15 tube, double conversion, super heterodyne, communication receiver, covering the frequency range of .45 to 31 mc in six accurately calibrated bands with full electrical bandspread. This Receiver is being used in all branches of communications from short wave listening to diversity receiver units (GPR-90D). Featuring the same precision construction of all TMC units, this Receiver is the finest in its class. Details of GPR-90D are available in BULLETIN 190. Details of the GPR-90 are found in Bulletin S-179.

RTC The RTC is a Remote Control Amplifier, designed to provide remote operation to the GPT-750 or similar transmitters for high impedance microphone. It provides peak clipping push-to-talk, CW and MCW operation. Designed in matching cabinet to the GPR-90 full details are found in Bulletin S-183.

DRP The DRP Diversity Receiving Package provides compact, easy to operate equipment for AM, FS, CW and MCW signals over the 2 to 32 Mc range. The basic receiver is TMC's Model FFR (AN/FRR 49 (V) and AN/FRR 502) and frequency shift is accomplished with TMC's Model CFA Converter using the PSP-1 power supply. Plug-in tuning drawers provide quick frequency changes with VFO or crystal operation. Complete details Bulletin S-170.

XFK The XFK is a highly stable exciter which replaces the crystal oscillator in the transmitter to provide "mark & space" carrier-shift transmission of teleprinter, telegraph, FM telephone, facsimile or telephoto intelligence. Carrier-shift up to 1000 cps available either linear, with applied voltage or independent of applied voltage. Range 1.0 to 6.9 mc in two bands. Full details - BULLETIN S-118.

THE TECHNICAL MATERIEL CORPORATION

IN CANADA: TMC [illegible] Ontario

MAMARONECK, N.Y.

vided into 11 sensitivity categories. Low impedance cells are intended primarily for direct relay operations, while high impedance cells are intended for use with an amplifier. The sensitivities range between 20 and 1,500 microamperes (5 megohms down to 67,000 ohms) at the very low illumination of 1 foot candle.

Applications include conveyor control, burglar alarms, counting, and smoke detecting.

Further information may be obtained by writing Hupp Electronics Company, Division of Hupp Corporation, 743 Circle Avenue, Forest Park, Illinois.

Three-Lead Phototransistor

General Transistor Corporation, Richmond Hill, N. Y., has announced the production of a new germanium P-N-P alloyed junction three-lead phototransistor.

Known as type GT-66, it is a miniature, light-sensitive photocell intended for use in circuits employing AC amplification for modulated light. It may also be used as a two-lead device with DC, unmodulated light.

Even though it is a miniature, it is capable of performance at a level sufficient to operate a relay. Some possible applications include tape and punch card reading, optical sound play-back, and industrial safety devices.

Central Power Tubes

Central Electronic Manufacturers, Denville, N.J., a subsidiary of Nuclear Corporation of America, is now producing two new tube types in its line of Nucor three-electrode power tubes.

These two new types, 7C25 and 7C23, feature double spiral filament of thoriated tungsten, and conservative ratings for long life.

The 7C25 is a forced air-cooled tube with anode dissipation of 2,500 watts and plate input of 7,000 watts.

One of the new line of Central power tubes.

Type 7C23 has a peak power output of 120 kilowatts. Its maximum pulse width is 90 microseconds, and it has a maximum duty cycle of 0.005.

Silicon Junction Diodes

Four new types of high conductance silicon junction diodes for use in precise signal rectification have been introduced by Texas Instruments Incorporated. These new diodes will have wide application in circuits requiring high, uniform forward currents and extremely low back currents at elevated temperatures.

At ambient temperatures of 150°C., all four types of these hermetically sealed, miniaturized units have forward current ratings of 25 ma and reverse currents of 30 ua. At 25°C., they have 100 ma forward current ratings and reverse currents of only 0.1 ua.

All units are glass encapsulated to insure complete protection against moisture and humidity and are axial constructed to allow point-to-point wiring. Each type weighs only 0.16 gram and is 100% tested to meet specified design characteristics.

These silicon junction diodes are especially desirable for applications in networks, modulators, and demodulators because of their uniform design characteristics.

A mulletin, DL-S 614, containing the diodes' design data and characteristic curves, is available from Texas Instruments Incorporated, 6000 Lemmon Avenue, Dallas 9, Texas.

Communication Antenna

A precision communication antenna, the CA 5-450, manufactured by Scala Radio Company, San Francisco, Calif., has been designed for general communication use.

Available for any frequency in the range from 300 to 550 mc, the antenna is complete with a 52-ohm type N connector and a clamp for fastening from a 2" to 2⅜" O.D. circular mast. It has a folded feed element and is protected from corrosive agents by a teflon insulated balun within a chamber filled with foam plastic.

Elements are supported to the boom by machined castings, making possible a much larger support area, and, at the same time, damping vibrations and reducing the concentration of stress and metal fatigue.

For the Photographer

Motion Analysis Camera

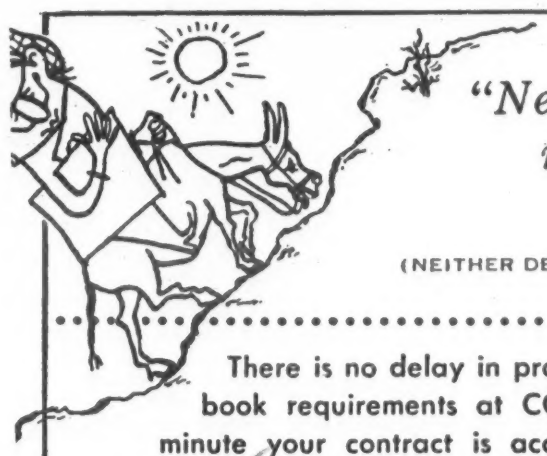
A high speed "motion analysis" camera capable of taking high quality pictures within range of 5,000 per second and incorporating the most advanced features of high speed photography, has been designed by the Fairchild Camera and Instrument Corp., Syosset, N. Y.

The lightweight camera, now undergoing field testing, has been designated the Fairchild Motion Analysis Camera and has been designed for versatility as well as speed.

This newest 16mm camera, utilizing rotating prisms, can be adapted to many variations, each for a specific use. An industrial model is planned which is capable of taking as many as 5,000 pictures per second.

The manufacturer claims that resolution tests of the camera have produced excellent results. Picture steadiness on projection is much better than that of intermittent cameras. By means of precision gearing asso-

(Continued on page 96)



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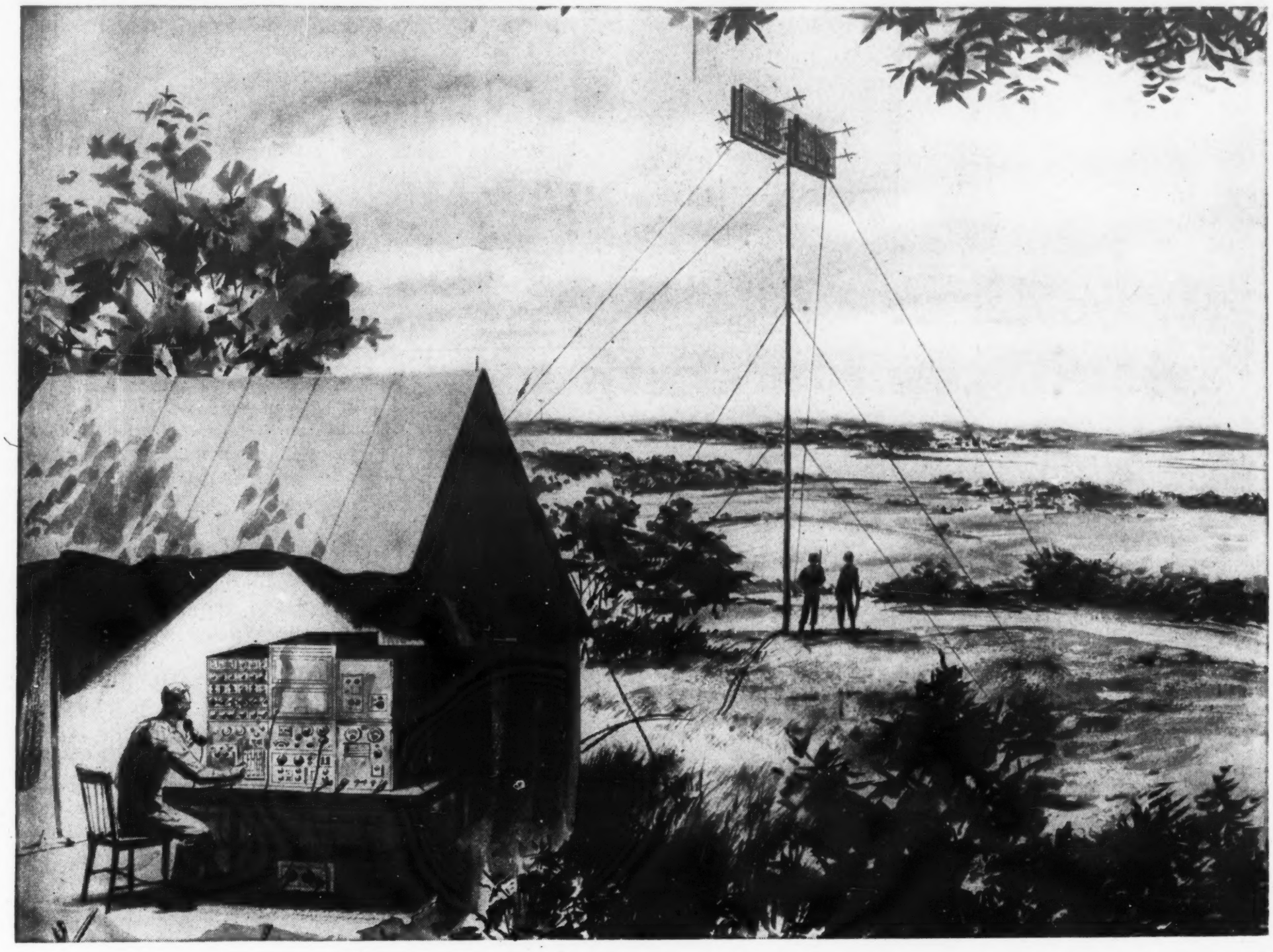


ANTRAC...a portable skypath for Uncle Sam's voice

ANTRAC (Radio Set AN/TRC-24) is a multi-channel portable communications system that links points 25 to 30 miles apart which, because of rough terrain or other adverse factors, cannot be bridged by wire and cable.

Produced by Western Electric from designs developed by the Signal Corps and Bell Laboratories, the ANTRAC radio set—conceived as an extension of the Spiral Four communications system—provides twelve voice channels. This is the first time a completely integrated wire and radio system of such large channel capacity has been available for tactical use by the Armed Forces.

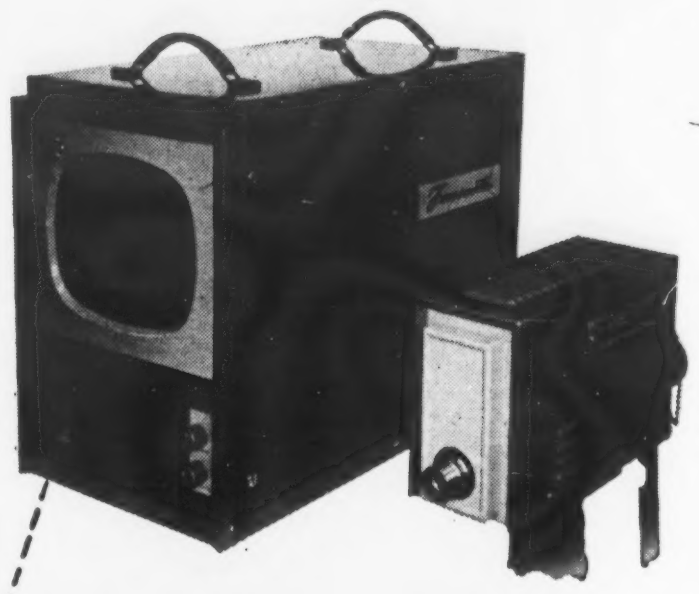
To meet field requirements, the equipment is packaged in convenient transit cases, with a 45-foot antenna mast divided into nine easily assembled sections.

All in all, ANTRAC illustrates very clearly how telephone technology continues to work for national defense . . . not only by contributing to such developments as radar and guided missiles . . . but by serving in the field of military telephone communications, as well.

Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

the **first** and **last** word in **visual communication**



Farnsworth

CLOSED CIRCUIT TELEVISION

"Let's you see . . . where you can't be"

From Farnsworth, where electronic television was *first* created over 30 years ago, comes the *last* word in visual communication—Farnsworth Model 600A Closed Circuit Television. Engineered especially for industrial, educational and commercial use this compact, light weight camera and portable monitor is saving time, and money in countless applications.
If yours isn't one of them it will pay you to get the facts from Farnsworth—today.

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NEW PRODUCTS

ciated with the prism drive mechanism, a steady picture is achieved.

The rotating prism has been selected for the highest possible index of refraction and lowest dispersion with a minimum thickness and minimum angle of incidence. The result is an evenly illuminated picture that has a sharp frame line, with no overlapping of images of one frame into the next.

The camera is light weight and compact—the housings being constructed of heat treated cast aluminum alloy, designed to stand shock.

The camera takes a 100-foot spool of 16mm film and operates at from 32 to 5,000 frames per second. Weight is only 9 lbs. and the size is approximately 7" x 6½" x 8½".

High Speed Camera

To meet the requirements of photographers who require a high-speed portable electromatic speed-light, the American Speedlight Corp., 63-01 Metropolitan Ave., Middle Village 79, Long Island, N. Y., has announced its new design, the Ascorlight AA-406.

The Ascorlight AA-406 operates either from a four-volt nickel-cadmium battery, A.C. or "D" cell battery pack, and has a built-in charger. The effective light duration of 1/2200 sec. eliminates many of the problems of "ghost images and wings" in action pictures.

Size and weight have been kept to a minimum, the shoulder weight being only 6½ lbs., including battery. The power controls are located on the side. The AA-406 uses a trigger-tube firing circuit which protects the shutter from damaging electrical current. Both A.C. and battery circuits are fused.

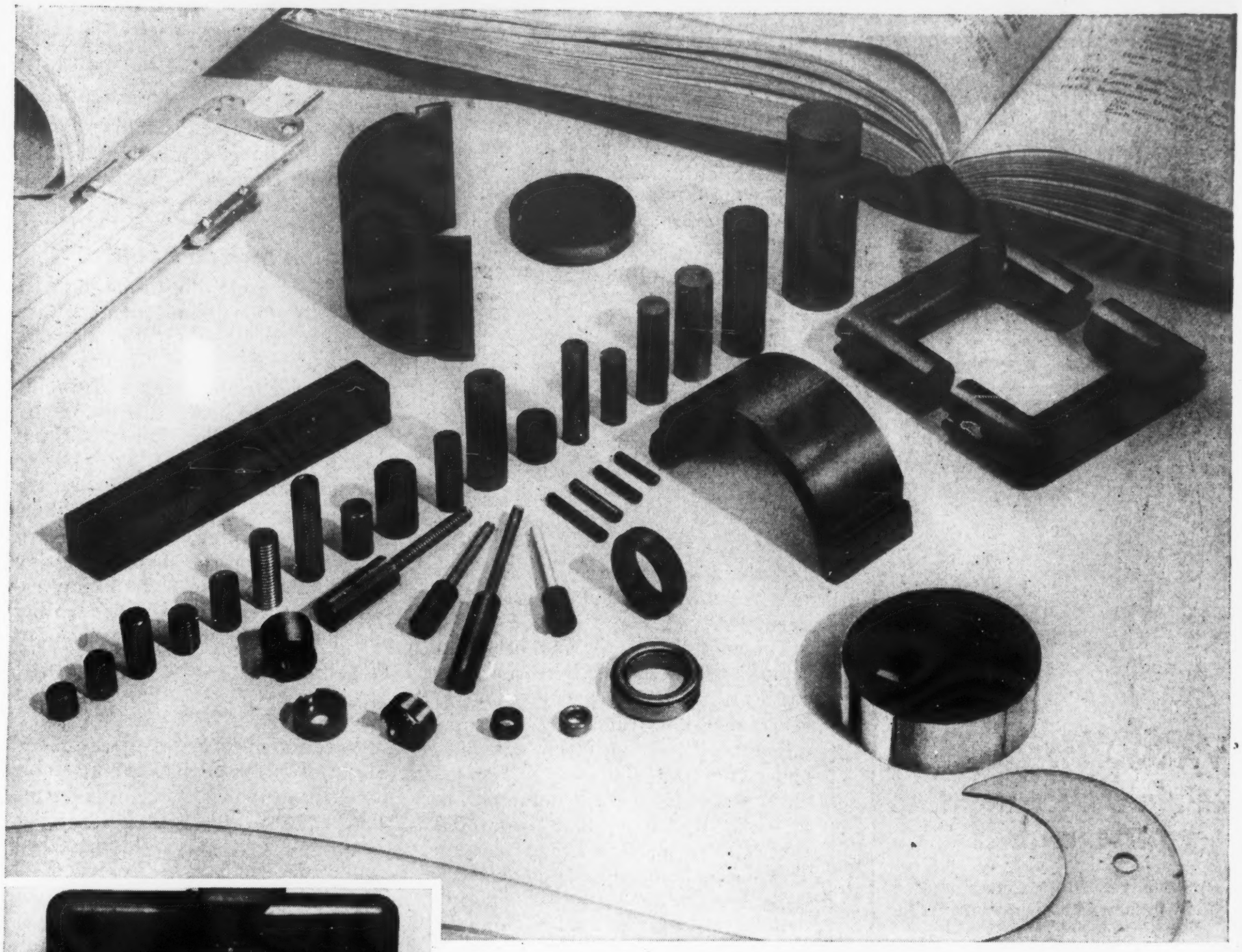
As part of the unit, a new light head with interchangeable reflectors and flash tubes allow flexibility of operation. Special internal surfacing of the reflector assures an even distribution of light for normal lenses.

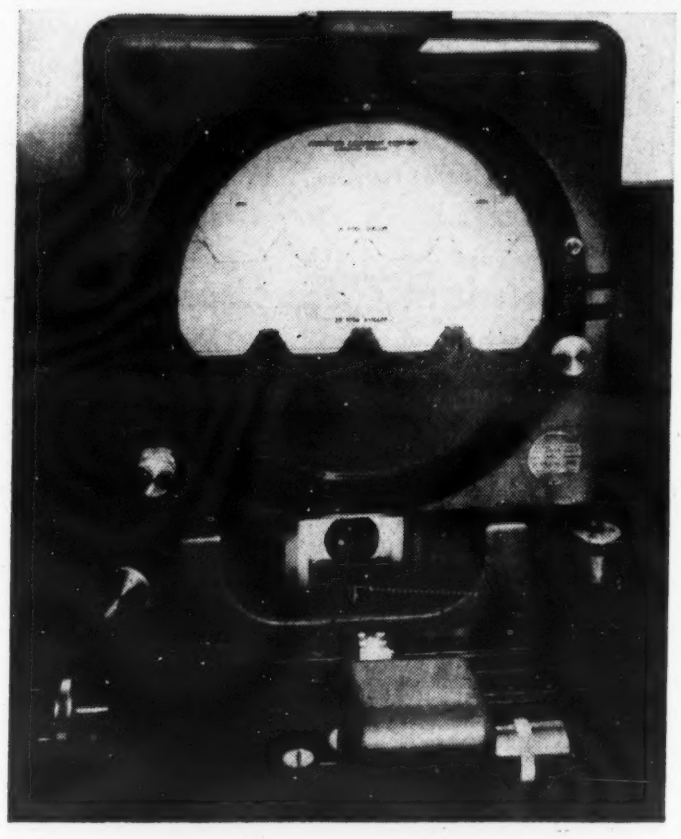
Bell & Howell Automatic Movie Camera

The first fully automatic movie camera, a camera with an "electric eye" which automatically sets the lens for perfectly exposed movies, has been developed by the Bell & Howell Co., 7100 McCormick Road, Chicago 45, Ill.

The camera operates on the same general principle as the human eye. A photoelectric cell, or electric eye,

(*Continued on page* 98)





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opens and closes the lens iris automatically to adjust to varying indoor or outdoor light intensities. Because the lens adjusts to changing light during filming, the photographer can follow a subject from deep shade to bright light without stopping to change the exposure. The camera, if desired, may be operated manually without the electric eye.

Current for the electric eye is supplied by six small mercury cells or batteries such as are now used extensively in hearing aids, etc.

Industrial X-Ray Film

A new Kodak industrial X-ray film, Type AA, which retains the fine sensitivity of Type A with greatly reduced exposure needs, is now available from the Eastman Kodak Co., Rochester, N.Y.

The new Type AA has been developed by the Kodak Research Laboratories to give the industrial radiographer new versatility in working with all types of X-ray machines and gamma ray sources.

Film speed ranges from approximately 1.3 to more than two times that of the widely-used Type A film. This faster film with its high sensitivity enables the X-ray technician to handle successfully many of the problems he encounters in his day-to-day operations.

With Type AA he may: reduce exposure time; provide increased radiographic sensitivity through higher densities with established exposure and processing techniques; give greater subject contrast, more detail and easier readability by using established exposure times with reduced kilovoltages; shorten the processing cycle with existing exposure techniques, and reduce the possibility of pressure desensitization under shop conditions of use.

New Literature

CREI Brochure

The Capitol Radio Engineering Institute has released a new edition of its brochure, "Your Future In The World of Electronics."

This 44 page brochure discusses the importance of advanced technical training, describes the institute's home study program, and outlines its courses.

There is also a nine page report on "Opportunities in the Radio-Electronic Industry for Technically Educated Men" in which is discussed the growing importance of electronics in the world, the status of various branches of electronics, career opportunities in the electronic industry, and the outlook for the future.

The booklet is available from the Registrar, Capitol Radio Engineering Institute, Washington 10, D. C.

Mycalex Switch Booklet

An eight page illustrated booklet describing the design, manufacture and characteristics of the Mycalex Model TM 55 series Commutation Switches for telemetering and similar applications is being distributed by Mycalex Electronics Corp., Clifton, New Jersey.

Suggested applications of the Model TM 55 switches include telemetering, sampling, signal comparison, remote control, data conversion and similar projects in which extremely low noise level, dependability and long operating life are major considerations.

G-E Tube Chart

A selection chart listing General Electric's 5-Star high reliability tubes for critical applications now is available from the G-E Tube Department.

The chart classifies the 34 tubes, applicable military specifications, heater voltages and currents, and gives average characteristics.

The chart (ETD-1276) may be obtained from the General Electric Tube Department, 1 River Road, Schenectady, N. Y.

Tantalum Capacitors Bulletin

Fansteel Type STA solid tantalum capacitors are described in Bulletin 6.110, available from Fansteel Metallurgical Corporation, Rectifier-Capacitor Division, North Chicago, Illinois.

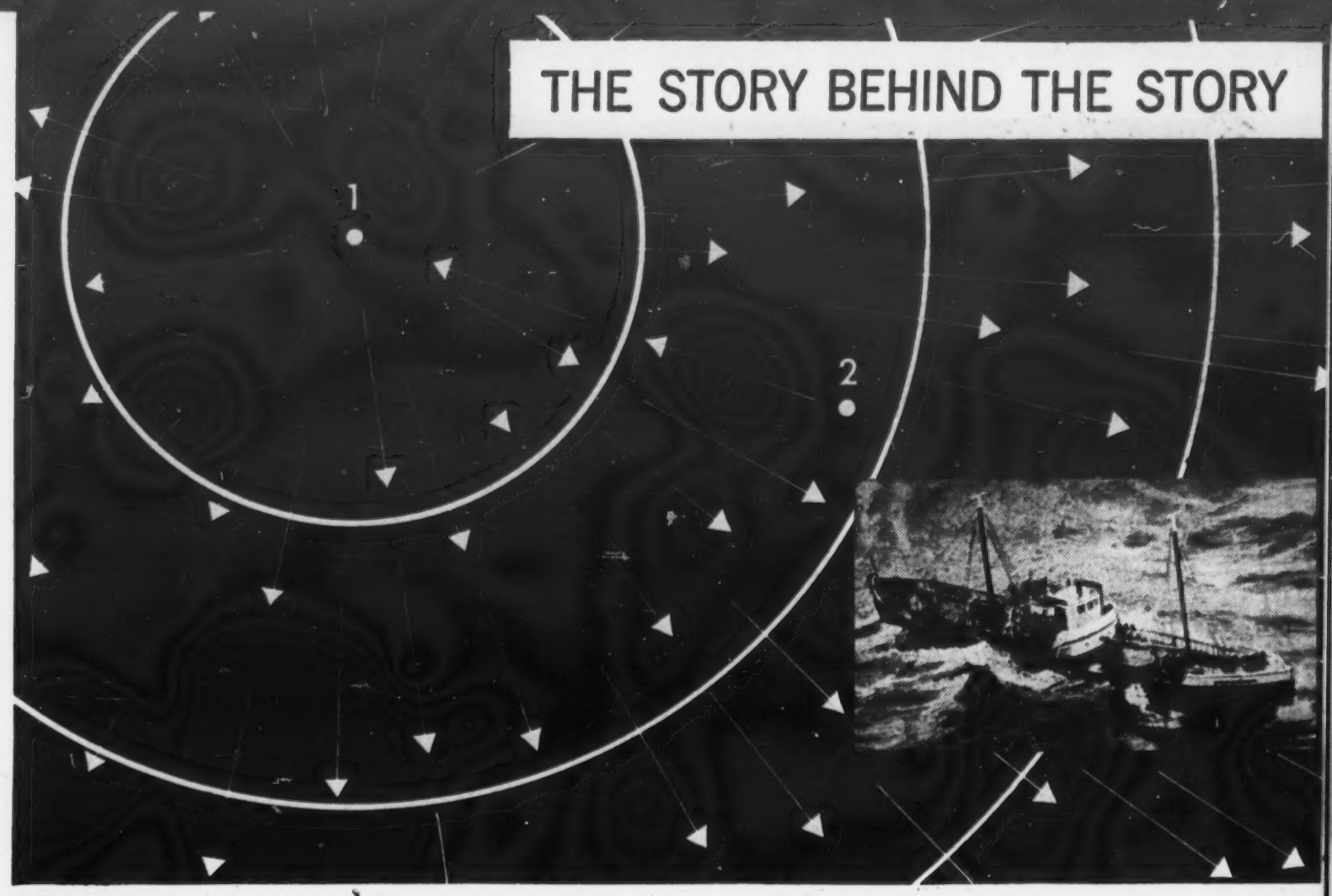
The bulletin lists 24 standard ratings from 1 mfd at 35 working volts DC to 350 mfd at 2 working volts. Three standard case sizes are used. The bulletin also contains performance characteristic curves.

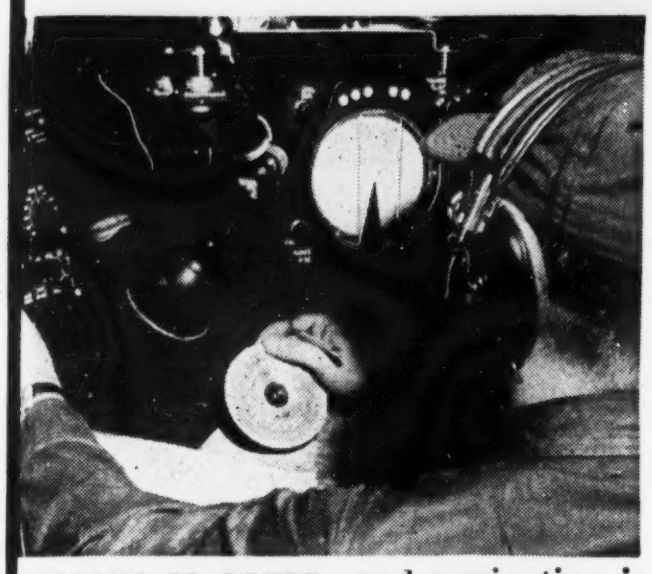
Triad Catalog

The 1956 edition of Triad Transformer Corporation's General Catalog has just been released. The new Triad Catalog illustrates and describes nearly 700 items, 76 of which are new to the line.

Copies of the new catalog, TR-56, are available from Triad jobbers, or may be obtained by writing to Triad Transformer Corporation, 4055 Redwood Ave., Venice, California.

THE PRINCIPLE OF ALL RADAR is illustrated at right. Radio waves, indicated by arrows, bombard any objects in their path and bounce back, presenting the object on the scope and indicating its range and bearing. With his Sperry Marine Radar, for example, the master of a ship (1) sees on the scope above the image of a ship in distress 9 miles away (2) and in total darkness.





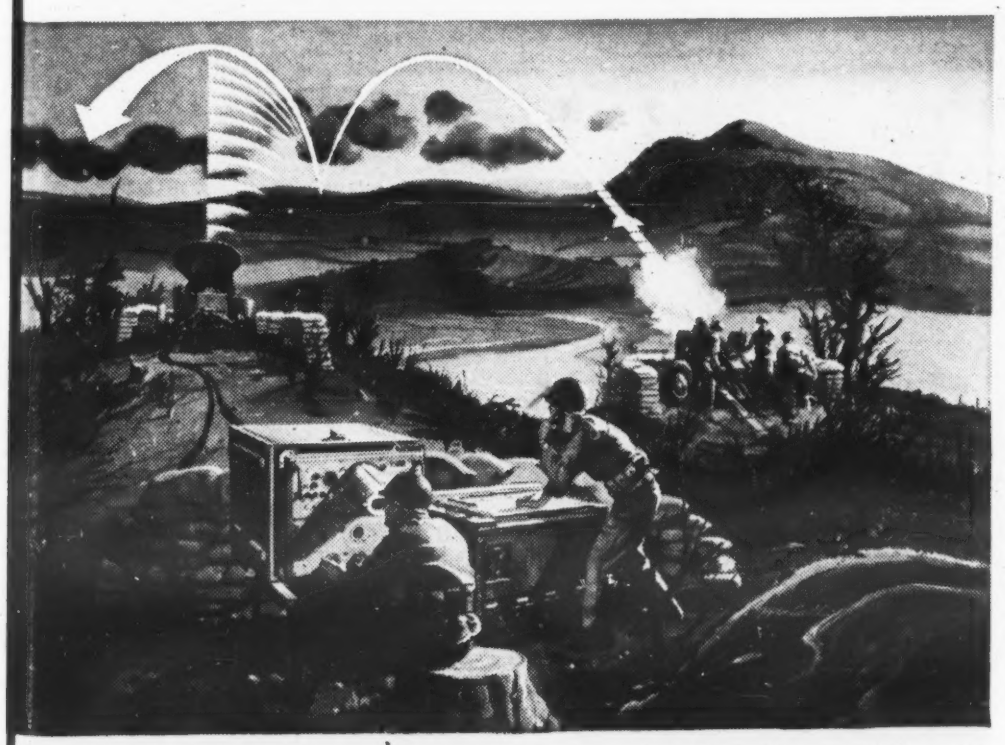
FLYING IS SAFER, and navigation is simplified for Air Force planes equipped with Sperry APN-59 Radar. For example, thunderheads and other weather disturbances are revealed in advance, so course may be altered to avoid storms.

RADAR: DETERRENT TO WAR, PROTECTOR OF LIVES

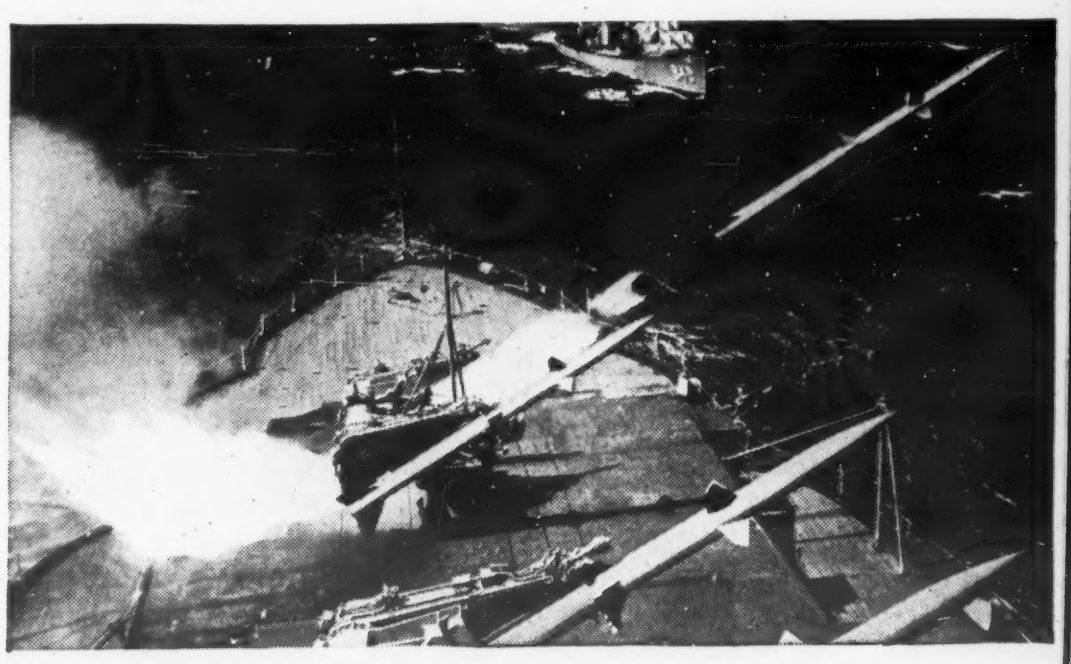
Its uses Expand as its Ability to Detect the Unseen Increases

In a few short years, radar has passed from the experimental stage into a highly dependable servant of humanity. It helps to keep the peace—because its use in early warning networks reduces the possibility of successful enemy attack, while its use in new bombing and missile systems increases the probability of deadly retaliation. By pushing darkness and storms aside, it increases safety in transportation, protects property and saves lives.

To provide a thoroughly stable source of power for radar, Sperry developed the Klystron Tube. From this, Sperry has gone on to pioneer in every phase of radar development, working with every branch of the military, and with industry as well.



GUNFIRE CONTROL SYSTEMS owe much of their precision to radar. For example, an important one, this Mortar Locator developed by Sperry for the Army, uses radar to track an enemy shell, then plots its point of origin to locate an enemy battery.



MISSILES FOLLOW COURSES established by radar whether launched from air, land or shipboard, as in the case of these Navy Terriers, radar-guided by Sperry.

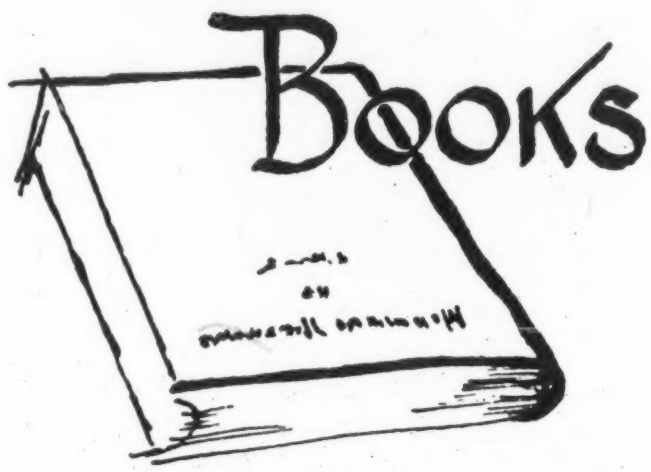
SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION

CLOSED-CIRCUIT AND INDUSTRIAL TELEVISION, by Edward M. Noll. The Macmillan Co., New York, N. Y. 230 pages, $4.95.

Entertainment being the area most extensively served by television facilities, industrial, business, educational and home applications of the medium still have areas which can be further explored.

However, as research increases in this field, more complex problems in closed-circuit television must be solved by the technicians and engineers. This volume is written to provide information about available closed-circuit systems, and to suggest some of the ways they can serve modern needs.

Suitable for use as a text in technical institutes and adult education courses on the principles of television transmission, the book emphasizes technical phases—systems, types of cameras and viewers, circuits and techniques, installation, and service. Included are details for constructing a small inexpensive camera which can be used for picture transmission on the bands prescribed for amateur radio operation.



GLOBAL LOGISTICS AND STRATEGY: 1940-1943. THE U. S. ARMY IN WORLD WAR II SERIES, by R. M. Leighton and R. W. Coakley. Office of the Chief of Military History, Department of the Army, Washington 25, D. C., 780 pages, $6.25.

This volume is one of the first systematic attempts since World War II to analyze in detail the shaping of the central direction of strategy of the Anglo-American high command by the limitations of supply and transportation. The authors have shown the interweaving of logistics and strategy in top-level decisions and how the logistical limitations which affected strategy were handled.

Describing the system of policy, means and organization for providing the Army's logistical support, the book contains the only published comprehensive account from an American viewpoint of the military lend-lease operations. Included are two revealing chapters on the aid-to-Russia operations, and the first exploitation of the War Shipping Administration records.

In addition to lacking the narrowly focused outlook of an agency history, the volume also seemingly avoids a white-wash of the haste, waste and misdirected effort of the period from 1940 to 1943. The story of the management of the North African landings, the establishment of a base in Britain for an attack across the English Channel, and the less than happy relationship between the Army and Navy and the Army's air and ground forces, especially in logistical matters, is detailed.

The present volume in the Series and the next volume covering the period from 1943 to the end of the war, make the coverage of these important military subjects complete.

ANALYSIS OF ELECTRONIC CIRCUITS, by W. H. Middendorf. John Wiley & Sons, Inc., New York, N. Y., 306 pages, $6.00.

Beginning with six basic physical laws and definitions established by the early experimenters, the premise is that the reader has only to learn the full meaning of these laws and to apply them with complex algebra to advance his present knowledge. The emphasis in this book is placed upon the reader to develop the ability to think for himself, with the examples and problems designed to stimulate his interest in this direction.

Basing his work upon his own successful classroom experience, the author deals with, and presents in detail, only those topics vital to basic understanding of the subject.

The volume is arranged into three sections: one written on an undergraduate level, the second and third for electrical engineering majors. Each article and chapter leads quite naturally to the next one, making an interesting story of circuit analysis, rather than just a collection of facts. Also included in this work is a chapter on communication circuits.

ENGINEERING IN HISTORY, by R. S. Kirby, S. Withington, A. B. Darling, F. G. Kilgour. McGraw-Hill Book Company, Inc., New York, N. Y., 530 pages, $8.50.

The most novel feature of this volume is its presentation of engineering in interaction with society. Generally, the history of engineering is written as though that particular field were divorced from human affairs, but the authors of *Engineering in History* have shown the dependence of advancement of this science upon various factors in the physical and cultural environment.

Developments in the United States, particularly, include new historical information with original, rather than secondary, sources used. Although special branches such as military, naval, and chemical engineering have been omitted, a good knowledge and understanding of engineering history is available to both the general reader and the student, the emphasis being placed on the development of civil, electrical, and some aspects of metallurgical and mechanical engineering.

For those who would like to obtain more detailed information on the subject, a short, general bibliography is given at the end of the book, with selected bibliographies following each chapter.

THE INCHON-SEOUL OPERATION, U. S. MARINE OPERATIONS IN KOREA, Volume II, by Lynn Montrose and Captain Nicholas A. Canzona, USMC. Historical Branch, G-3, Headquarters U. S. Marine Corps, Washington 25, D. C., 361 pages, $2.50.

The story of the Marine Corps' landing at Inchon is that of an historic amphibious operation conducted under the most difficult weather and geographic conditions. This volume, which deals with the Inchon-Seoul phase of the Marine Corps' strategy in the Korean Conflict, is the second in a projected five-volume series dealing with Marine operations on the Chosen peninsula from August 2, 1950 to July 27, 1953.

Presenting the operation in detail from the mobilization of the Marine Corps reserves into the Division and Aircraft Wing, to the seizure of Seoul and its environs and subsequent withdrawal to prepare for the Wonsan attack, the book is primarily a description of Marine tactics, with those of the other Services mentioned only to keep the entire operation within its proper perspective.

CHINA'S CHANGING MAP, by Theodore Shabad. Frederick A. Praeger, New York, N. Y., 295 pages, $7.50.

Based on primary Chinese and Soviet sources, this volume is an up-to-date and comprehensive political and economic geography of China under Communist rule. The first systematic survey of all autonomous minority areas organized and copied from the Soviet system by the Chinese is included, as well as the first ordered presentation of economic statistics for China's industry, agriculture and transportation.

All recent name changes of cities and other geographic features are given, and a complete listing of all Chinese minorities with their population (based on the 1953 census) is also included.

Official U.S. Air Force Photograph

Friend or foe? Tactical defense officers in MINK control center watch movements of aircraft as reported from radar warning sites. This is equipment developed under the direction of Rome Air Development Center.

ROME AIR DEVELOPMENT CENTER PROVIDES AIR DEFENSE EQUIPMENT FOR OUR AIR FORCE

One development agency for the Air Force's ground-based electronic equipment is Rome Air Development Center, located at Griffiss AFB in Rome, N. Y. One of the ten centers of the Air Research and Development Command, RADC is concerned with the air defense of our nation, with providing equipment for tactical supremacy, and with developing ground complexes for various navigation systems to aid all aircraft. In addition, RADC is charged with data handling improvements for the Air Force intelligence mission.

RADC is the responsible center for development, through its various contractors, of such end products as radar sites, including improved tubes, circuits, antennae, and shelters; ground communications equipment and associated support items; IFF (Identification Friend or Foe) environments, and electronic countermeasures.

Bringing complex systems from the written requirements to the actual hardware items to be used in the various Air Force commands is a long and tedious business which draws upon the skills of RADC's 500 civilian and military engineers and their many counterparts in private industry.

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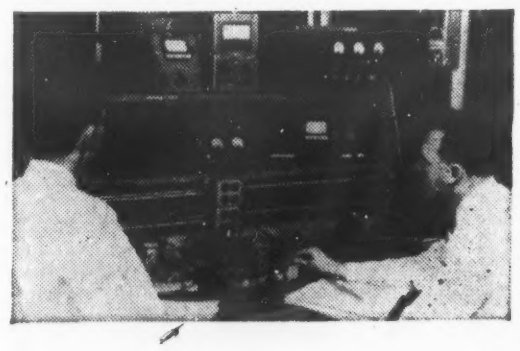
This is one of a series of ads on the technical activities of the Department of Defense.



Engineers at Ford Instrument Company working on a special Air Force project in one of the company's laboratories.

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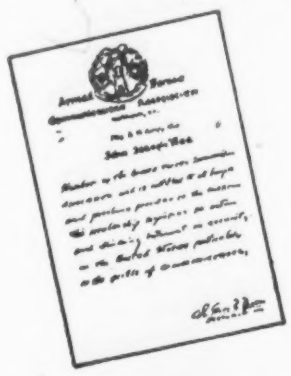

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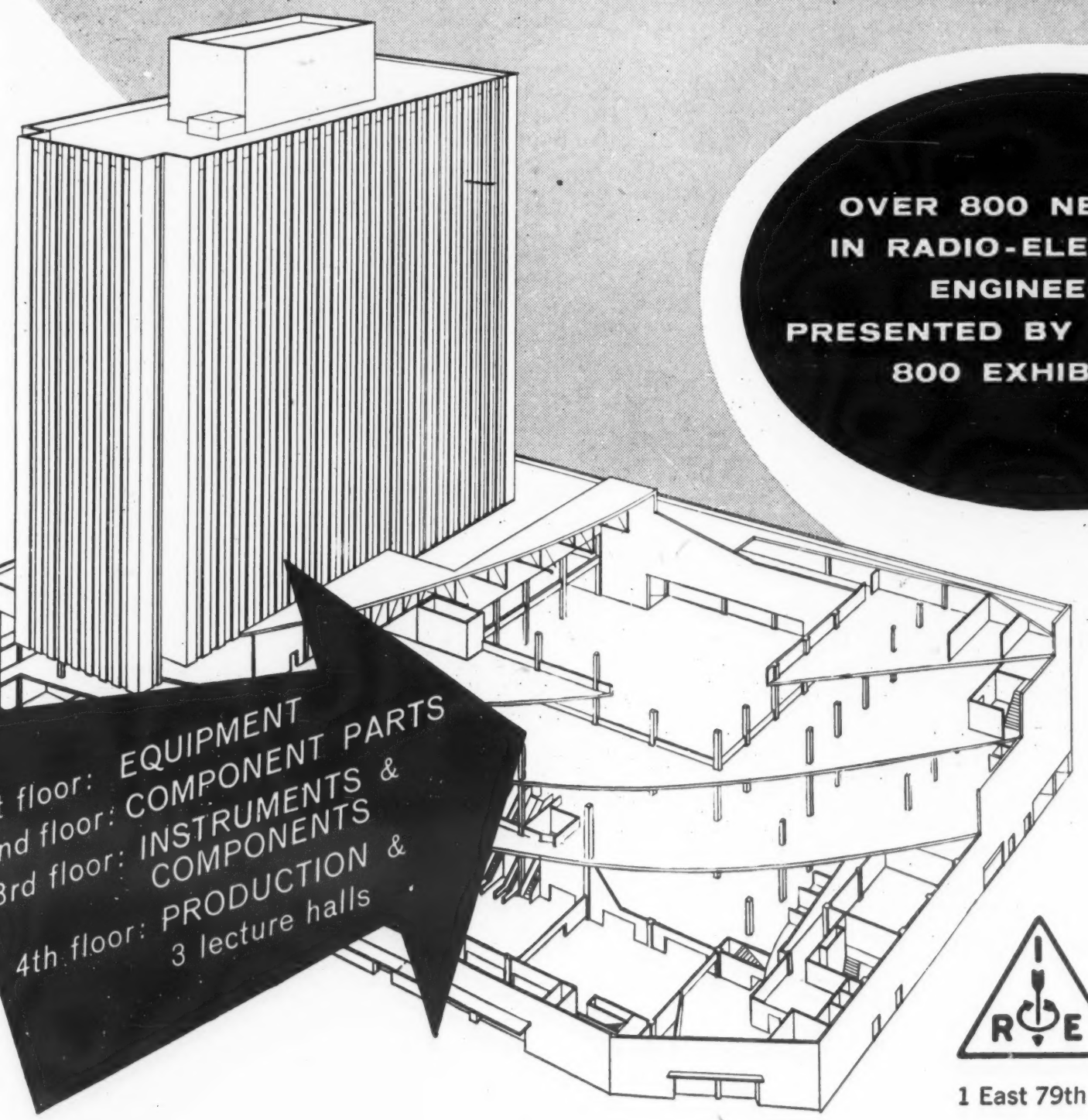

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The Institute of Radio Engineers

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September-October 1955 to July-August 1956

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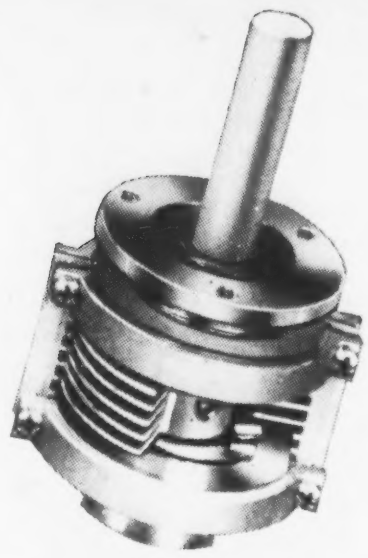
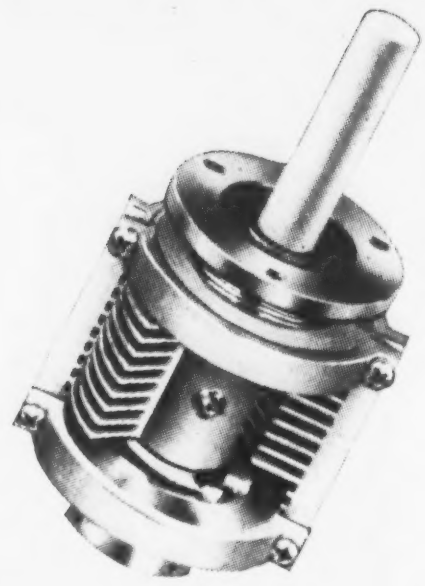
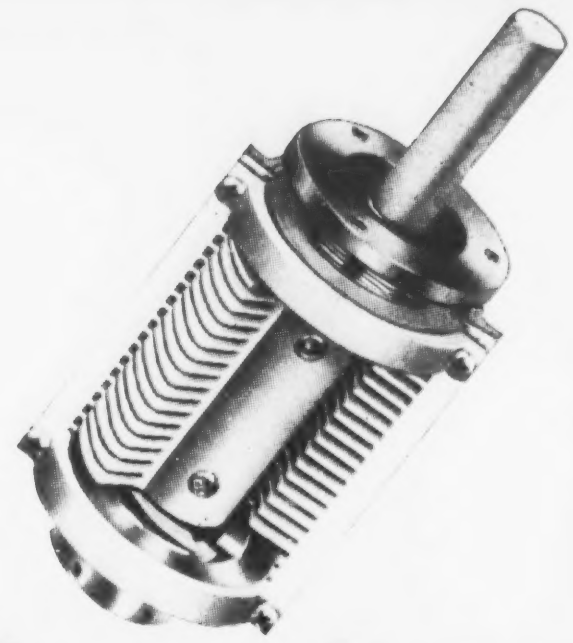

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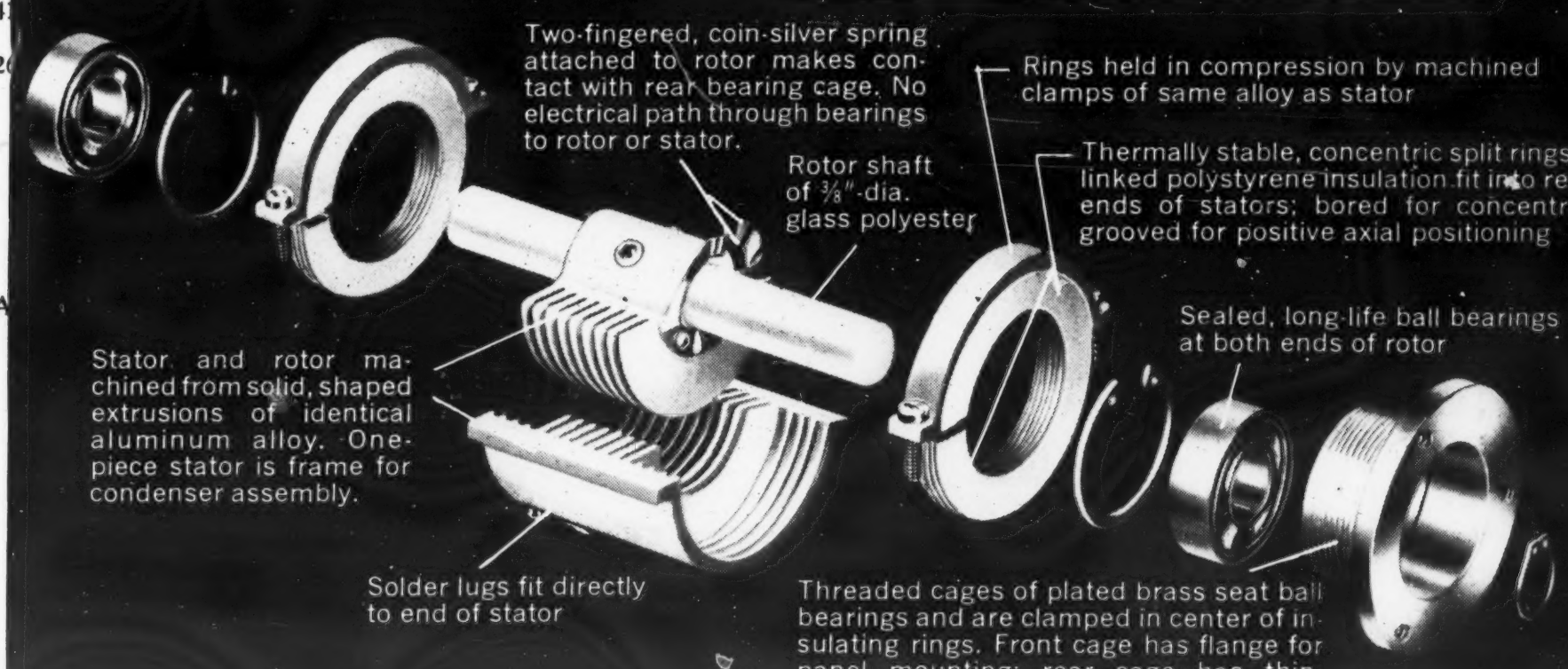
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